Labour Canada Travail Canada

IN THE CHIPS: OPPORTUNITIES PEOPLE PARTNERSHIPS

Canada

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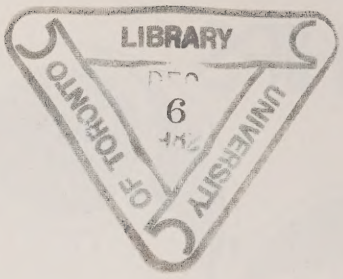
Report of the
Labour Canada Task Force
on Micro-Electronics and Employment



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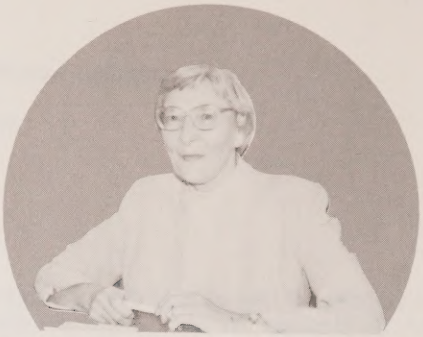

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The Honourable Charles Caccia,
Minister of Labour,
House of Commons,
Ottawa.

Dear Mr. Minister:

On March 17, 1982, you entrusted us with the mandate to examine the implications of microelectronics for all aspects of harmonious and productive industrial relations in Canada. We first met as a group on March 26, 1982. Being aware of the serious misgivings in certain quarters surrounding technological changes, and of the need most Canadians see for truly co-operative institutional and legislative arrangements to guide such changes, we submit our report to you today and urge immediate action.

We take this opportunity to express our deepest appreciation to those citizens of Canada who shared with us their excellent briefs, presented thoughtful views and practical ideas, and who took the time to write, or to talk with us informally, giving of themselves so generously in this consultative process. Our report is mainly the fruit of their contributions. It reflects people's preoccupations about working life and their fears, hopes and aspirations about adapting microelectronic technology for the benefit of all Canadians.

Respectfully,

The Members of the Task Force on Microelectronics and Employment

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TABLE OF CONTENTS

CHAPTER I

Technology is Only a Tool

"The material object ... can't be right or wrong. ... [it doesn't] have any ethical codes to follow except those people give it. The test of the machine is the satisfaction it gives you. There isn't any other test. If the machine produces tranquillity, it's right. If it disturbs you it's wrong, until either the machine or your mind is changed."

- Zen and the Art of Motorcycle Maintenance -

INTRODUCTION

In 1981, the Women's Bureau of Labour Canada convened Canada's first national Conference on the Impact of Microelectronics on the Industrial Work Environment. Representatives from labour, business, industry, women's groups, educators, other interested citizens, and governments expressed their views on and concerns about the new microelectronic technology. At the conclusion of this Conference, participants agreed that a task force should be established to look more deeply into the issues involved, to hear from a broad spectrum of Canadians, and to make recommendations for public discussion and action.

Our Task Force came into being on March 17, 1982, when the federal Minister of Labour gave us the responsibility of examining and reporting the implications of microelectronic technology (microchip) on Canada's workplace. This report is our contribution to a process of change which, to be fully beneficial for the country, will require the full cooperation of the main economic decision-makers, the representatives of workers most likely to be affected by technology and those others who could influence constructive change.

At our first meeting on March 26, 1982, we were struck by the pressing need to create fresh and more contemporary approaches to cooperation necessary to enhance this process of transition.

In this report we tried to address four principal questions:

1. Can our economy and our society afford to ignore the opportunities made possible by micro-chips?

2. Are the technological changes resulting from micro-chips properly understood?

3. Does an environment exist in Canada that is conducive to an efficient and equitable adoption of micro-chips into the workplace?

4. Can an effective and integrated process of change be instituted to enable the adoption of technology in the workplace in such a way as to ensure that undesirable effects of such a development are minimized?

Most of the briefs and participants agreed that the advent of the silicon chip represents a quantum leap in the evolution of world technology: in only a few decades, a roomful of vacuum tubes and other components have been reduced to the size of a cornflake. Because microelectronics can now be introduced in almost any sector of society, the chip will have far-reaching implications in every sphere of economic activity and in every area of employment.

While "chip revolution" was a term the members of this Task Force heard over and over, clearly what is happening is better described as a "chip evolution."

An evolution can be modified, or hastened and controlled, by those who understand it. This Task Force was, then, created to contribute to this evolution by recommending necessary reforms, both legislative and institutional, to maximize the positive impacts

and minimize the negative consequences thus ensuring a more equitable distribution of the burdens and benefits of microelectronics.

Task Force members readily admit that the challenge proved formidable. The issues that must be investigated by any inquiry into the implications of microelectronic technology are numerous, interrelated, complex, and worrisome. They include some clearer understanding of (1) the triggering technologies, (2) microelectronics and work, (3) industrial relations, (4) quality of working environment and work, and (5) training and education. In considering the foregoing factors, further attention must be paid to the fact that women workers are likely to bear an unfair share of the costs of the transition to an information and microelectronic society.

In order to keep our work manageable and deliver our report without undue delays traditional to Task Forces and Commissions, we tried to focus on the larger and more universal concerns related to technological change. These concerns are characteristic equally of office as well as industrial workers. Job insecurity constitutes a real threat not only to individuals but also to the overall goal of economic growth through technological change. Unless this preoccupation about job security is recognized, it will work to retard the pace of development. While job security must be an important consideration, it must not be mistaken for job permanence or for a guarantee that the same job will continue to exist. The need for adjustment mechanisms such as training and retraining is critical to all workers whether they are women or men, engaged in blue-collar or white-collar work. The details about their needs may vary, but the essentials remain the same. Our report should be read with this in mind.

The many groups which appeared before us persuaded us to view our mandate in a broad perspective in order to deal with all of these pertinent issues. While in no way minimizing the difficulties ahead, the Task Force clearly sees microelectronics as a tool with the potential to create jobs, to increase productivity, to improve economic growth, and to enrich personal development. Although women appear to be terribly affected by the fear of this new technology, and their presence in the world of high technology is sparse, we have become aware of a number of women who have seized new job opportunities in microelectronics. We offer three instances to exemplify how women without even any background in technology too can benefit: a former welfare recipient is now a successful microelectronic equipment salesperson; an unsuccessful filing clerk is now a senior representative for a microelectronic manufacturer; and a former nurse is now a member of a computer policy team in health sciences.

Since the use of microelectronics promises to be so wide spread, and the concerns of all workers, specifically women, are so deep, the Task Force realized it must make recommendations that address the main facets of economic and social well-being and not be limited solely to recommend action to be taken by the Federal government.

Three important conclusions emerged from our deliberations.

First, technology, in itself an inanimate tool, is neither good nor bad. The benefit or harm it brings is dependent on how people employ it. Decisions on the organization of work and the design of the workplace must be influenced both by social and technical considerations. Technological advance does not have to result in a stultifying work environment. Depending on the values that people bring to the workplace and the structures set up to deal with work issues, technology, including microelectronics, can be life-diminishing or life-enhancing for workers.

The second conclusion is that microelectronic technology promises to bring enormous gains in efficiency and productivity. It is not a cure-all, to be sure, but, properly handled, it can contribute in a significant manner to an economic recovery, and thereby, over time, lend to an improved social well-being of the people in Canada.

Thirdly, in order that micro chip technology may be used to its fullest extent, technocrats and decision-makers must be receptive to social and human considerations. The Task Force fully agrees with the belief that new technology cannot be utilized efficiently in an environment of social agitation, whether that agitation is eloquently silent or strident in its manifestation.

During the public meetings, it became very clear that different groups saw technology from totally different viewpoints. First, the optimistic one, which saw modern technological development as the means of solving all our present social problems and the way to achieving a utopian society; second, the pessimistic one, which visualized all the anti-utopian aspects of technological evolution that reduce workers to being mere extensions of the machine.

Each of these perspectives tends to be unduly simplistic. While a single-minded emphasis on increased productivity and automatic economic growth tends to ignore potential negative consequences such as underemployment, and unemployment, the pessimists are inclined to fixate on an analysis which would paralyze constructive action.

Reasonable citizens cannot dismiss the fact that some scientific advances do turn out to be hazardous to life itself. History is replete with examples of experimentation and products whose negative side effects were completely unanticipated at the time of discovery. Some more recent examples are related to asbestos, and various chemicals. While past errors are regrettable, the lessons learned can prevent similar mistakes in the future development of technology, including microelectronics.

A third and more dominant perspective which recognized these complexities emerged from the briefs and research. This view not only acknowledged the problems associated with the newer technologies, but also noted the challenge of the future and the absolute necessity of immediately seeking alternative methods of bringing about a new age - an age that could evolve into a "micro millenium". Responsible and intel-

ligent choices must be exercised if alternative futures laden with better social and economic benefits are to be possible.

Since work for the vast majority of people is what gives life purpose, the recommendations of the Task Force are aimed at creating more jobs and building a framework of cooperation among employers, employees and governments, so that the widespread application of this new chip technology will be done safely, smoothly and equitably. While this Task Force feels that the historical evidence and the intermediate growth projections involving the application of microelectronics technology in the workplace suggest important employment gains, it would be shortsighted of us to hide behind the uncertain future in a way that ignores the present. There is no doubt in our minds that developments through microelectronics will imply in the short term some measure of employment loss and disruption in the labour market. The effects of these disruptions, however, can be minimized, but only if we seize upon adjustment initiatives immediately. It is toward this end that we recommend, among other things, the creation of a Canadian Centre of Technology, Work, and Human Priorities, the development of a national microelectronic technology strategy, more government support for research into and development of microelectronic technology, reform of the Canada Labour Code, and harmonization of federal-provincial labour, safety and health, and training and education policies.

This report deals with the character of triggering technologies, microelectronics and work, cooperative and productive labour-management relations, quality of work and working environment including health and safety, quality of working life, women's concerns (addressed throughout the report in various sections), and the need for new and better training and educational programmes. We realize that decision-makers concerned with our economy would wish to adopt all available measures to boost our sagging productivity. Decisions in this regard should in our opinion, be guided by the often ignored but obvious fact that while modern equipment and processes are important, nothing is more important than the people who can, in the final analysis, make or break any such productivity drive. Our report is offered in the hope that labour, industry, governments and others concerned with the integration of chip technology in the workplace will take steps to promote its use in a manner designed to enhance life itself.

The need for action is urgent.

CHAPTER II
RECOMMENDATIONS

A. Triggering Technologies

1. In order to improve productivity growth and augment the international competitiveness of Canadian industry, thereby helping to enhance job creation in every region of the country, we recommend that the Government of Canada and the provincial governments substantially strengthen their programmes which support high technology industries and which promote and facilitate the introduction of microelectronics in the private sector, with particular emphasis on small- and medium-sized businesses.

2. To ensure equitable economic and social benefits for all Canadians, we recommend that the Federal Government continue to use tax incentives, credits and other programmes to:

(a) stimulate research, development and innovation in our high technology industries;

(b) stimulate the development and growth of a Canadian software industry;

(c) give preference to hardware and software firms owned and controlled in Canada by Canadians;

(d) augment its assistance to small- and medium-sized microelectronics businesses willing to locate in economically depressed communities throughout Canada.

3. We further recommend that the Federal Government establish and fund an independent Canadian Centre of Technology, Work, and Human Priorities reporting annually to the Parliament of Canada, with representation on its governing body from labour, industry, government, education and the voluntary sector, including special interest groups such as women's organizations. The mandate for this Centre should include:

(a) continuous consultation, liaison and cooperation with labour, industry, federal and provincial governments, educators, and other interested parties in order to:

(i) identify and assist in creating work and training possibilities on a high priority basis, to serve the severe needs of people in communities with the highest level of unemployment;

(ii) advise on the development, promotion and implementation of a comprehensive national microelectronic/information technology strategy;

(iii) advise on the development of education and training policies related to microelectronic technology;

(b) conduct short-term and longitudinal research and analysis, including monitoring, of:

(i) the social and economic impacts of the introduction and implementation of microelectronic technology in all sectors of the Canadian economy;

(ii) the social, economic and productivity trends and impacts, consequent to the

implementation of microelectronic technology, of alternate structuring of the workplace and job redesign;

(iii) changing social values affecting people's perceptions of work and work environments;

(c) conduct public awareness programmes, in cooperation with existing microelectronics centres, to ensure public understanding of the potential of microelectronics for productivity and the roles of labour, industry, government and all others centrally involved in technological change;

(d) establish and maintain the exchange of research and information with other industrialized countries;

(e) monitor the implementation of the recommendations contained in this report.

B. Microelectronics and Work

4. In order to improve labour force (supply and demand) projections in relation to the diffusion in the economy of microelectronic technology, and to formulate educational and training policies relevant to this diffusion, we recommend that Statistics Canada regularly collect and publish, as quickly as possible after collection, specific labour force data broken down by sex, sector and region on:

(a) age and educational characteristics of the labour force by occupational group and industrial class;

(b) geographical, occupational and inter-industrial mobility of the labour force;

(c) employment structures (part time, full time, amongst others);

(d) job vacancies.

C. Industrial Relations

5. In order to help ensure that the diffusion of microelectronic technology in all economic sectors and regions of Canada will occur relatively smoothly and equitably, the Task Force recommends that Labour Canada give serious consideration to the development of a more contemporary legal framework for promoting, encouraging and sustaining greater cooperation between employees and employers. While we have left it to others to add flesh to the framework which we consider necessary, the basic features of this general concept, which follow, are clear.

6. It is further recommended that the definition of technological change in the Canada Labour Code should be amended to mean the following:

(a) the introduction of new equipment or material; or,

(b) a change in the manner in which work is carried out that is directly or indirectly related to the introduction of new equipment or material.

This definition would serve to activate discussion and planning as soon as the employer proposes to introduce any new equipment, or as soon as a change in the way work is performed which is related to the introduction of new equipment, whichever occurs first.

7. Because Part III of the Canada Labour Code provides minimum protection to both unionized and non-unionized employees, and because our review shows that collective bargaining may be a deficient instrument to provide adequately for technological change, we recommend that a new series of provisions be introduced to this Part of the Code. The legislative scheme which we envisage would require all employers of 50 or more employees to engage in ongoing discussion and consultation with employees or their representatives, in anticipation of technological change. This scheme should make clear provision for the following essential components:

(a) a requirement that employers provide a minimum of 180 days notice of a proposed change, and that the necessary contents of notice be specifically defined in the statute;

(b) a requirement that in each undertaking where 50 or more persons are employed, there be established Joint Technology Committees. We consider these Committees to be an expanded and perhaps more effective version of the Planning Committees created under section 60.11 of the Labour Adjustment Benefits Act (Bill C-78);

(c) a requirement that Joint Technology Committees develop adjustment plans in anticipation of technological change and that these plans include measures designed to (i) adequately provide for job security, such as training, retraining and relocation of employees likely to be affected by change; and (ii) provide adequate planning for severance adjustments for those who may be displaced by change;

(d) a requirement that any disputes arising out of the imple-

mentation of the statutory scheme or relating to the adequacy of adjustment plans be settled by arbitration.

This arbitration provision could be modelled on the one currently found in Part III of the Canada Labour Code to deal with unjust dismissal. We would recommend, however, that a more streamlined route to arbitration be made available for technological change disputes than is now available for unjust dismissal complaints.

8. The composition, functions and powers of the Joint Technology Committees should be clearly defined as part of the statutory scheme. We consider the functions of the committee to include the following:

(a) to examine and discuss management's technology policy and any plans to invest in new technology;

(b) to consider and review the possible effects of technological change;

(c) to design adjustment plans which are tailored to the establishment and which are adequate to offset any anticipated negative employment effects of technological change;

(d) to consider issues related to the organization and design of work; and

(e) to develop educational programmes to familiarize employees with new technology.

9. The current scheme provided in Part V of the Canada Labour Code should be substantially revised to recognize and incorporate the minimum provisions set out for Part III of the Code.

D. Quality of Working Environment and Work

(i) Health and Safety

10. The Canada Labour Code, Part IV, define occupational safety and health to accord with the definition endorsed by Canada at the International Labour Organization's "Convention Concerning Occupational Safety and Health and the Working Environment" (1981). The definition is:

> "... the term 'health' in relation to work indicates not merely the absence of disease or infirmity; it also indicates the physical and mental elements affecting health which are directly related to safety and hygiene at work."

11. In view of the numerous and complex health and safety questions relating to microelectronics equipment, especially visual display terminals (VDTs), we recommend that the Government of Canada and the provincial governments:

(a) continue to fund medical and other research into health and safety concerns of people working with microelectronics equipment, especially VDTs, including more research into the adequacy of currently acceptable levels of radiation and the methods of testing for radiation emission as well as testing and research concerning other possible risks such as polychlorinated biphenyls (PCBs).

(b) based on research findings, develop and adopt health and safety standards for workers using office automation equipment including VDTs to cover such factors as:

(i) visual considerations;

(ii) other physiological considerations;

(iii) psycho-social considerations in the workplace.

(c) based on research findings, develop and adopt ergonomic standards for office automation equipment and workplaces to cover such factors as:

(i) physical environment;

(ii) design of office equipment and furniture.

12. In the interim period, until health, safety and ergonomic standards for office automation equipment and workplaces are adopted by the appropriate legislative bodies, the Task Force suggests that employers accept the following guidelines concerning VDTs:

(a) that pregnant women have the right to be reassigned to other positions without loss of pay, seniority and benefits;

(b) that the maximum time limit for VDT operators not exceed five hours per day;

(c) that rest breaks for VDT operators be provided hourly;

(d) that initial eye tests, followed by annual retesting be conducted for VDT operators at employer's expense;

(e) that corrective lenses specially adapted to the visual demands of VDT work be provided to

the employee, where necessary.

13. That the Canada Labour Code, Part IV, be amended to introduce Safety and Health Committees as permanent features of workplaces with over 50 employees.

14.(a) Women working at home with VDTs or other microelectronic equipment should be assured proper conditions of work and benefits by employers and these workers should be protected by suitable labour legislation.

14.(b) Close electronic monitoring of work be prohibited as inconsistent with human rights legislation throughout Canada.

15. As microelectronics make possible new forms of work and new structures in the workplace, measures be taken by respective levels of government to ensure that part-time workers receive prorated benefits, and that persons working at home, are assured minimum labour standards.

(ii) Women

16. Although women make up more than forty percent (40%) of the labour force, two-thirds (2/3) of women workers in Canada are concentrated in those positions which are currently prime targets for efficiency and productivity improvements via the introduction of microelectronic technology. Thus the disproportionate problems which women workers now face are caused not only by the new technologies, but also by occupational segregation and discrimination based on sex and age. Therefore the Task Force's recommendations for alleviating the anticipated disproportionate impact of microelectronics technology on women must also address the broader range of women's concerns.

In addition, the Task Force believes that the reorganization of the workplace, necessitated by the introduction of microelectronic technology, offers Canadians a unique opportunity to more fully integrate and implement the principles of sexual equality and equality of opportunity in the labour force.

Based on the two above concepts, and because of the wide spread fear that women will be further disadvantaged by the new technology, the Task Force recommends that immediate attention be given by public and private sector employers to:

(a) strengthening progressive hiring, training and promotion policies by appropriate legislation, to help ensure that women are not disproportionately affected by technological change;

(b) providing special opportunities for upgrading women's educational qualifications for admission to training and retraining programmes and for entry to apprenticeship programmes. These special opportunities are needed particularly by women entering the labour force for the first time and by older women re-entering the labour force.

The Task Force further recommends:

17. New and innovative work and training schedules be adopted to help ensure that workers, particularly women are not disadvantaged either in the work place or in training programmes because of their additional family responsibilities.

18. "Bridging" positions be created, where appropriate, to aid workers, more critically women, in administrative support jobs to make a smoother transition to positions offering greater opportunities for occupational mobility and career advancement.

19. In restructuring the work place, appropriate measures be taken to avoid:

(a) the isolation of women from mainstream workers by the creation of large electronic office equipment pools;

(b) the de-skilling of workers which results from excessively routine and fragmented work.

20. It is further recommended that women persist in strengthening their position in the labour

force by activities, including the following:

(a) investing more time in educating themselves about technology and in being fully aware of the evolving employment opportunities;

(b) making better use of existing support services such as networks, associations, community groups, women's offices, women's studies and other resource centres;

(c) encouraging parents, teachers and guidance counsellors to emphasize the value for female students in pursuing mathematics and science courses through junior and secondary educational levels;

(d) developing educational opportunities more appropriate to their dual responsibilities, for example by:

(i) encouraging all television undertakings to provide educational programmes related to high technology;

(ii) attempting to introduce a block-education concept similar to the block-parent concept to make possible a greater sharing of information, knowledge and expertise in computer and microelectronics-related fields involving local libraries and community-based resources.

E. Training and Education

21. The Task Force strongly endorses not only the spirit but the intent of the recommendations made by the Parliamentary Task Force on Employment Opportunities for the 80's (Work For Tomorrow: the Allmand Task Force) relating to the effects of microelectronics on training, employment, education and work. Many of those recommendations are echoed in this report.

22. The Task Force recognizes that computers- and computer-related technologies themselves constitute powerful educational tools which society can learn to apply in most instructional environments. They can be uniquely adapted to meet the training and educational needs of people with many different kinds of disabilities to enhance their potential for communication and self-sufficiency. We recommend public support for the design and development of software programmes to meet the special training needs of socially disadvantaged and disabled people.

23. We recognize that the effects of microelectronic technology on the family and other social institutions is of concern to Canadians in grass roots organizations, and encourage these groups to form a pan-Canadian network to develop new concepts of learning and social adaptation.

24. We also recommend that the appropriate federal and provincial ministers help ensure that Canadian education policies and programmes emphasize flexibility and adaptability to change by promoting a philosophy of life-long learning and the teaching of such lifetime skills as problem solving and decision making, by reviewing:

(a) educational systems, to ensure equitable educational opportunities throughout Canada based on co-operatively established national educational guidelines;

(b) current educational policies and programmes in light of the challenges presented by microelectronic technology, including the comprehensive integration into the educational system of computer-aided learning.

25. Furthermore, the federal and provincial governments should:

(a) encourage the continued development of educational, including technical, institutions; and

(b) provide additional funding to educational, including technical, institutions for the purchase of microelectronics equipment needed for instructional purposes.

26. The Federal government should establish a Registered Training and Education Leave Saving Plan to help individual Canadians take the initiative in planning and paying for their educational and training needs.

27. Governments, labour unions, employers and educational institutions should view educational opportunities, including training, retraining and higher education as shared cooperative responsibilities, which would include:

(a) the training of displaced workers to assist them to develop new and marketable skills;

(b) the desirability of negotiating educational leave provisions in collective agreements;

(c) preparation of appropriate information and orientation material for dissemination in the educational system to achieve a wide-spread level of microelectronics awareness.

28. Appropriate school authorities should attempt to ensure that sufficient people are educated for the evolving computer-related occupations and the microelectronic/information age by:

(a) adding new courses to school curriculum to ensure computer literacy;

(b) promoting a greater awareness of the role played by governments, industry and labour in the development and implementation of new technologies.

29. Educational authorities, publishers and educational media should work together to eliminate sex-stereotyping from all course materials and content in order to reduce the cultural barriers which impede the participation of women in high technology occupations.

F. Follow-up

30.(a) In view of the federal-provincial division of power relating to the administration of labour and safety and health legislation, we urge Labour Canada to initiate consultation with the various jurisdictions in order to discuss the possibility of harmonizing legislation so that Canadian workers can expect equal protection when they relocate from one jurisdiction to another;

(b) Lastly, we strongly recommend that Labour Canada provide continuity to the work carried out by this Task Force.

CHAPTER III
MAJOR FINDINGS AND IMPLICATIONS

Excerpts from Briefs, Submissions and Other Materials

- "Projections for job loss range from very positive--a fully employed population with increased leisure time and a high standard of living; to very negative--massive unemployment and a society characterized by a few idle rich and many idle poor. The reality will no doubt, be somewhere between these two extremes.

  It is difficult to estimate what proportion of unemployment would be due to microtechnology and what would be due to general economic climate and market conditions. The fact that the full scope of the application of microtechnology is unknown also makes it difficult to judge its impact."

  National Union of Provincial Government Employees

- "It is difficult to sort out the most important ingredient now since Japan has less than 6% unemployment and is making use of microtechnology on a larger scale than Canada that now has over 10% unemployment."

  Canadian Advisory Council on the Status of Women

- "In the 1960s automation eliminated hundreds of thousands of industrial jobs across this country ... In retrospect, however, the original near hysteria which suggested that jobs would vanish by a quarter past four this afternoon if we didn't do something turned out to be absurd."

  Desmond Morton, Labour Historian

- "We in Canada must act to produce a cooperative procedure whereby we can earn and share the many benefits to be derived from the application of high technology. Should we fail to produce such a producedure the social and economic impacts could be disasterous."

  Canadian Federation of Labour

- "It will be necessary for all parties (employers, unions, employees, governments) to cooperate in the introduction of change so that all segments of society will benefit. Where change is implemented properly, it is a positive force in the employer/employee relationship and for the economy."

  Canadian Manufacturers' Association

- "... we believe measures can be adopted which will ensure that the technology will be beneficial to all Canadians."

  Public Service Alliance of Canada

- "Microtechnology offers our society the chance of great advancement but only if it is introduced for the benefit of all."

  Communication Workers of Canada

- "On a more positive and general note, we also see great opportunities for the whole of society with the intelligent use of technology."

  National Action Committee on the Status of Women

- "We are aware microelectronics will present new possibilities and new benefits to society. The advantages for the disabled are impressive. Employers will benefit by the lower cost, increased productivity and efficiency of the microchip. Novel directions and discoveries in leisure activities will emerge. All will benefit from a growing range of innovative services."

B.C. Federation of Labour

- "Our union is not naive enough to think that it can stop the revolution, nor do we want to. To the contrary, we want to be part of it."

National Union of Provincial Government Employees

- "Another factor which will affect the speed with which new technologies are introduced is the attitude of workers. Employee cooperation is essential for the successful implementation of technological change and will be forthcoming provided employers make a commitment to retrain and relocate their personnel. Employers must also be responsive to the health and safety concerns of their employees."

The Canadian Bankers' Association

- "The government and all other employers in Canada must not consider the people obsolete simply because their skills are obsolete."

Federation of Women Teachers' Association

- "Those planning for change and the introduction of computer aided systems will have to see that the people whose jobs are affected are well informed, that their needs and concerns are considered, and that they have help and understanding to make the transition from the old to the new a success."

Canadian Pacific Limited

- "... employers must pay greater attention to the impact of change on their workers, in addition to the consideration given to other factors of production, such as plant, equipment, raw materials and finances. Employees must be confident that they will be treated properly when dislocated in some fashion by change."

Canadian Manufacturers' Association

- "Training is the key to adapting to technological change and increased investment must be made in order to meet the growing skill and technical manpower requirements of the new technology."

British Columbia Telephone Company

- "... business does have a social responsibility to provide for people displaced by technological change."

British Columbia Employers' Council

- "... we pledge to you our complete support and we will work with you to help ensure that the introduction of micro-technology to that part of the workplace in which we have an interest is accomplished with the fullest possible recognition of those human and social considerations ..."

AES Data Limited

- "La femme ne doit pas échapper aux changements technologiques. Elle se doit de les bien maîtriser."

La Fédération des femmes
du Québec

A. Triggering Technologies

Although the current recession has been marked by the collapse of many traditional manufacturing industries, we have at the same time witnessed the rapid growth of new information industries, many of which, despite the adverse economic environment, are exploding into the global market. The world is on the threshold of change from an industrial to an information economy. It is a time of anomalies, contradictions, reversals, paradigm shifts and, for those who fail to appreciate the nature, direction and depth of the transformation, a time of constant surprises.

We are only really beginning to edge into the age of information technologies. The sense of movement and change that has already occurred is in itself remarkable. Virtually any book, article, or television programme which discusses the recent developments in electronics, computers or telecommunications that drive the new wave of electronic automation, is characterized by an outpouring of superlatives and staggering comparisons, expressed sometimes in tones of awe or admiration, and very often of shock.

The introduction of automation and information technology into our society has been under way for about a generation. The catalyst to the process has been microelectronics -- the chip. Hailed as the most remarkable technology ever encountered by humanity, the chip, which is smaller than a fingernail, contains hundreds of thousands of electronic components and complex circuits. The power of the chip, which was developed in the early 1970s, has increased a hundredfold over the past decade, while at the same time its costs have dropped a thousandfold. The chip is spreading through the economy like a secret, its diffusion rate being seven to ten times faster than that of any previous technology.

Why? While everywhere else prices are escalating, microelectronics costs are on the decline; memory chip costs are falling by 40 per cent a year, the cost of logic chips by 25 per cent, and even communications costs are shrinking at the rate of over 10 per cent a year. What is more, the use of the chip inreases reliability, improves energy efficiency, and assures great portability.

At no time in history has there been a broader range of innovations and technologies based on a single invention poised for commercial development and diffusion. The range of emerging or fast-growing technologies is broad, diverse and advancing with increasing rapidity. Simultaneously, the range of application of these technologies is continuously expanding. There is as much invention in the applications area as there is in the development of the technologies themselves. The results of all these parallel developments is that the relative cost of information goods and services is decreasing even further.

Many Faces of Microelectronics

Microelectronics thus drives a whole cluster of technologies, such as computer-assisted design (CAD) computer-assisted manufacturing (CAM), (robotics),

digital signal processing, and packet switching, speech processing and expert systems. In conjunction with new developments in opto-electronics (such as lasers, optical discs, and optical computers), these technologies are likely to become the force which will produce profound changes in the way we work, learn and live.

Several generic technologies appear to be the pacesetters of the change. Rapid developments in chip technology itself, as well as in microprocessors, memories, software and speech processing are all pointing towards dramatic changes in the factories and offices of Canada.

In chip technology the progress will bring higher component density (i.e., the number of elements which can be placed in a volume of space), higher processing speed (the number of times an operation can occur in a given unit of time), and higher transmission speed (the speed at which signals travel between operational elements).

It is expected that by 1985 we shall see a chip with some 300 000 components. A little piece of silicon will have the power of an existing mainframe computer. One major class of chips --- the memory chip --- is already being mass-produced with over 65 000 memory elements. Firms in the U.S. and Japan are already working on the development of ever larger chips. A chip with a million memory elements is expected by 1983. By 1990 it is expected that microprocessors will compress some ten million transistors onto a single chip. These will not necessarily be made up of silicon as at present.

Chips made of new materials, such as gallium arsenide and others, which will allow much faster processing speeds, are in the offing.

World semiconductor markets are doubling every five years. Presently totalling $14 billion a year, they are expected to grow to $25 billion by the mid-eighties, and to $50 billion by the end of the decade. A fifty billion dollar chip industry in 1990 would suggest a $700 billion electronics industry, largely dependent on the new technologies. It will be dominated mostly, if not exclusively, by the Americans and the Japanese.

Dramatic progress is expected in the development of computer memories. By 1990 much of our requirements for memory in electronic equipment will undoubtedly be solid state -- i.e., semiconductors (mentioned previously). Their increased use suggests that significant volumes of programming will be built directly into the electronic equipment.

While the electronics establishment has been rather cool towards the already promising bubble memory, the most surprising development in memory is the realization by manufacturers that commerical videodisc technology offers a computer memory with an incredible storage capacity-to-cost ratio. Each optical disc side, with 54 000 frames, can hold some 10 billion bits of information. A single videodisc could store all of the information in the Encyclopaedia Britannica, and the entire contents of the world's largest library could be stored in a filing cabinet of optical discs. It is

likely that a good part of computer memories will be in disc form by the end of the decade.

In addition to offering competition (and some displacement) to the magnetic memory industry, optical discs promise to restructure not only the publishing and archive industries, but also our public and private libraries. A great market is also opening up for electronic filing cabinets for business information.

Innovations in the Wing

As the cost of hardware tumbles, the cost, and therefore the importance of the software (instructions to the machine), is increasing dramatically. Software's heart is the machine language. Next comes the operating system, the syntax of the language, which establishes how things must be expressed. Finally we have the application programmes, (useful for solving problems), with a set of instructions on how the problem is to be approached. All of this is called software.

Given the escalating costs of developing new programming, and the chronic shortage of personnel, packages of general instructions have become more and more widespread. Some authors of these new software packages have become millionnaires. The world software industry is expected to be valued at over $100 billion by the end of this decade. It thus emerges as a new big international business.

The most fervently pursued field of software is the area of so called "expert systems". The rules used by professional experts in diagnosing complex situations are elucidated and encoded in the computer, and then gradually tuned up through practice, until the diagnosticians' expertise is captured. Expert systems already exist in prospecting, translation, and medical diagnosis, and new areas are being opened every day. Automated paraprofessional systems for the legal, medical and accounting professions are expected by the early 1990s.

Another area of rapid progress is the area of voice processing. A much more difficult area, and one that will be therefore slower to perfect, is that of voice recognition, which will have a number of potentially extremely useful applications. It could help pilots or captains to control the vessels better; it can be used for stock taking, and it will be used for telephone directory inquiries. Security systems could be voice-activated, paraplegics can use it to control their instruments and vehicles, and voice-activated typewriters are around the corner. The list is growing daily. Compared to speaking to computers (voice recognition), listening to them (voice synthesis) is technologically easier to achieve. A number of applications, such as talking copiers or microwave ovens and even talking elevators, have already appeared on the market.

The innovations discussed previously are the building blocks of the office of the future. As the range of new products and services is unfolding exponentially, it is quite possible that, as the decade proceeds, equipment will become simpler. The eighty or so buttons and controls of a home computer or word processor may be reduced to one or two, as

happened with radios as they left their adolescence. Undoubtedly too, like radios, information equipment will become smaller, lighter, cheaper, portable, personalized, and able to access a far greater range of information than its crude predecessors. Tomorrow a computer could be fitted into an electronic briefcase; soon after into an electronic agenda book; and perhaps ultimately into something we could wear, like a hearing aid. These developments all suggest that the office of the future might well dispose of most of the objects presently in use, which could go the way of the blotter. Even office buildings might become obsolete!

It is difficult to imagine what the office of the future will be like, and how it will evolve, if we insist on lumping different kinds of offices together. On one side we might see a new high-tech company started by a group of computer scientists, growing at 35 to 50 per cent a year on the global market. All of the senior executives have spent their school and professional lives experimenting on a computer terminal and are familiar, if not friendly, with front-line uses of the technology. Using electronic mail and computer conferences is a natural continuation of the way they have worked all their lives. Writing a programme to shortcut traditional procedures is the form of their business. They have followed the literature on expert systems and are impatient to put them to work to keep the firm lean, mean and hungry. As entrepreneurs, they stand to benefit directly from the productivity gains they can develop, as well as from avoiding unproductive past practices.

On the other end of the spectrum, is the large corporation in older industries, with well-established traditions, and a hierarchy appropriate to an earlier era when these traditions were first established. This type of corporation has automated much of its industrial activity, and now finds itself with a proportionately large administration. It has an oversized data processing (DP) department, with an aging mainframe computer. Any changes in the operation of the company require corresponding changes in the machine's programming, a process fraught with difficulty due to the immense scale. Middle managers, planners, in-house consultants, and others frustrated by the slow responses of the data processing department to their information needs, have taken to smuggling personal computers to their desks to speed up and improve their work.

The idea therefore that the entire business community could and would uniformly transform itself into the paperless office between now and 1990, (i.e., in three thousand days), is hard to take seriously. At the moment, paper is still the major medium of communication and record keeping in business. Entrenched traditions give priority to what is written. We will probably not be quick to abandon paper entirely for the electronic medium.

However, we would not be wise to project current trends in office automation as occurring exclusively through the evolutionary process. There may be fundamental new thrusts taking place in technology which could change the course of conventional

thinking. Two great visionary projects -- the Japanese Fifth-Generation Computer, and the Centre Mondial Project in Paris -- might accelerate and significantly modify conventional expectations of information technology development.

Unquestionably, these and other advances, such as those in the areas of fibre optics, lasers, computer-assisted design/computer-assisted manufacturing, industrial robots, and other developments in factory automation, will contribute to a profound change in the workplace as suggested earlier.

This wave of new technologies differs from that of the past. Previous technological changes have typically come into public use in isolation and in series. Today, the rate and breadth of technological change is so great that the interactions between old and new technologies, or between a combination of new technologies, have farther reaching, more complex implications than ever before.

Responses Overseas

In examining how individual countries react to the new technologies, one perception emerges almost immediately: jolted by the oil shocks, all advanced industrial societies desire to move away from consumption of energy and resources. They have discovered in microelectronics a vehicle by which they can move "upmarket" and restructure their economies to produce higher value-added products and services. This response to the microelectronics challenge, first articulated by the Japanese, but now accepted to a degree which one might almost call an international consensus, recognizes that the progressively merged computer and communications technologies offer the key to technological progress in almost every industry, and hence form the cornerstone of industrial strength, export capability and national sovereignty: all goals which no nation including Canada dares to ignore.

In this new situation, governments have become increasingly involved in research and development (R & D) and formulating national industrial strategies. As we enter the 1980s, we have witnessed the polarization of views about the role of government in new technology development. On one side, technological nationalism has been spreading. Japan and France have become the most committed to nationally planned technology development. Japan has a clearly articulated national strategy which seems to be very effective in bringing the country into the forefront of the new technologies.

France's recently formulated national strategy seems to be starting to show some visible results. Politically motivated, France has recently even opted for the nationalization of the key information infrastructure industries.

The camp of the laissez-faire nation-states is led by the United States. It must be recognized that the size of the market, the richness and diversity of the industry, the proliferation of multinational corporations, and its global influence, make the United States a special case. Only that country can afford to be without a comprehensive national strategy for the new technologies.

Calls for formulating a national strategy have increasingly been heard in other laissez-faire countries such as the United Kingdom, West Germany and Sweden, which have nevertheless committed may more resources to strengthening the national capability for emerging new technologies than has Canada.

Canadian Approaches

Canada has still to articulate a national strategy in this area.

As has often been said, the new information companies are job creating, wealth-creating, balance-of-payments favouring, energy conserving, and non-polluting -- in short, ideal companies of the future. The products and services which they create not only add to our wealth, but often to our productivity, rejuvenating tired, old institutions and industries. In addition, by turning our attention outward to the world, they offer the opportunity to heal the wounds of a dying industrial age, self-inflicted by conflicts between labour and industry, between government and industry, between federal and provincial governments.

The harsh Canadian economic reality, with the tumbling of our gross national product (GNP) and with our country sliding to the seventeenth position in productivity growth among the Organization of Economic Cooperation and Development (OECD) countries, call for a dramatic turnaround in productivity improvement.

Since the introduction of meaningful productivity gains through new automation will require the collaboration of labour, government, industry, as well as that of major institutions such as media and education -- in short a mobilization of all resources -- a new scenario for Canada is required. The mobilization scenario brings with it an analysis of the problem on a global scale, an estimate of domestic strengths and vulnerabilities, and a meeting of minds on the manner of mobilization. Accompanying this is a programme of opportunities -- an immense training programme to bridge the shortages and surpluses expected in the labour market, and the realignment of our institutions to keep us in pace with the newly emerging world, which will soon account for nearly a third of industrial production in the advanced countries.

As our non-renewable resource industries (at least the mega-projects), seem to be in jeopardy, our medium- and long-term salvation may rest with nurturing small- and medium-sized Canadian-owned companies in the high technology field, controlled in Canada by Canadians.

Canadian ownership is important because the autonomy of decision-making is an essential component of success in the time critical world of high technology. The quality of head office jobs is also derivative of this autonomy. R&D representing the capacity of the company to regenerate itself is generally kept under the direct control of the president. Profits in the form of dividends or stock appreciation are retained in Canada to refinance the process. As long as control of the fortunes of the company remain in Canada, meaningful jobs would be created

in support of this decision-making process. Canadian shareholders would also have the returns to reinvest. The Canadian investment climate, must however, have to become favourable (to the extent it is possible in the present international circumstances). (During our review we learned that a significant amount of Canadian funds have been flowing out of Canada for investment into high technology companies in the United States).

Aside from the large critical mass of corporations which have their roots in such ventures as telephone and electrical technologies, and are clearly formidable forces in the advance of the information society, the roots of our new industries of the future are more likely to be traced to small- and medium-sized Canadian - owned firms in the more technology-intensive industries, which are less than ten years old or at the most "teenagers." Entrepreneurial spirit is an essential component of their make up. For these firms, access to international markets is not adequate -- their ability to originate and domestically control technology, and design, is, at present, unquestionably linked to Canada's skills to perform well abroad. They must move quickly to enter a market window and they must keep near the leading edge of their technologies to update their products over a very compressed life of about three years.

High technology must be encouraged to grow in every community across Canada. In fact, high technology industries individually or collectively, by pulling their resources and ingenuity with the assistance of government programmes and through the Canadian Advanced Technology Association (CATA) should take on the challenge of revitalizing many economically depressed communities. A demonstration project should be put into a community, essentially a one-industry town, which had to face or is facing upheavel. Also helpful could be the example of Jamestown, New York, where labour, management, voluntary groups and governments collectively resuscitated it to a flourishing vital town. If there is a will, there is a way. The interaction needed in this process, between companies, universities and research centres for intellectual stimulation and exchanges of expertise is, despite our geography possible in Canada -- through Canadian inventiveness as manifested in our highly successful computer-driven, satellite-sustained communications infrastructure.

The microelectronics wave is here and we can ride it towards higher productivity. We agree with labour historian Desmond Morton, who wrote:

> "The paradox that politicians and perhaps even workers in Canada have been slow to grasp is that only in innovation is there security for an industrial society". (Canadian Forum, March 1982)

Required Action

In this perspective, the shared interest in using microelectronics to improve our productivity offers perhaps a unique opportunity for creating a new form of cooperation between all the Canadian social

actors, who all have a stake in the improvement of the economy. Their joint action could ensure that the productivity growth occurs with minimum disruption and with effective sharing of both costs and benefits.

To understand the unfolding of the microelectronic era, we need to monitor the changes as they are occurring so that we can at least get a sense of where we are at any point in time, and establish a basis for shorter-term trend analysis and timely input into public policy, and establish a more effective adjustment to emerging realities in employment and the economy. To meet the need for such effective and ongoing activity on these underlying issues, full-time single-minded attention is critical.

What is being done to make such a prospect a reality in Canada?

At the federal level, a flurry of activity is being carried out by such departments and agencies as, Industry, Trade and Commerce, Communications, Employment and Immigration, Science and Technology, Science Council, Revenue Canada, Finance, and the National Research Council. Their programmes range from supporting the research, development and application of new technology to encouraging innovation in Canadian industry. Also included are programmes aimed to respond to industry's needs for skilled workers and providing adjustment mechanisms, such as training and worker assistance plans. Labour Canada is looked upon to maintain a tension-free industrial relations environment within its jurisdiction. In addition, the combined presence of two super ministries: Economic and Regional Development and Social Development, which jointly, in addition to their overall responsibilities, are expected to provide coordination to the programmes put forward by a number of departments and agencies interested in this area.

At the provincial level, primarily Ontario, Manitoba, British Columbia and Québec have been actively engaged in making high technology an integral part of their economic development efforts.

The industry acknowledges that it needs federal assistance in terms of research and development (R & D) support. It also recognizes that the "private sector and government must cooperate if Canada is to be an international contender in high technology."

We in Canada can take immense pride in having one of the most advanced and efficient telecommunications sectors in the world. Our successes in the use of advanced communications technologies are well recognized. Our leading roles in high-speed digital communications, fibre optics, packet switching, satellite technology, Telidon, Canadarm, and office of the future systems are acknowledged around the world. These successes are, mainly, examples of individual initiatives, determination and entrepreneurship buttressed unquestionably in many instances by government assistance. If such successes were possible without a fleshed-out strategic plan, one must consider what might be possible for Canada, if we were to have a fully articulated strategy in this regard.

The micro-electronics industry -- known as the sunrise industry -- is increasingly being looked upon as creator of jobs (estimates cite that 500 000 jobs could be created over the next decade), an indisputably rare and devoutly wished for commodity all around. It points out that the absence of a comprehensive microelectronics strategy, and a rather piecemeal, half-hearted approach to the exploitation of technology, is at best, fragmented and inefficient, and at worst, wasteful of valuable time, energy, and imagination -- a key ingredient to development.

To us, Canada's efforts thus far, notwithstanding our isolated success stories related to research, development, marketing, commercialization and application of microelectronic technology appear to be rudderless. What is urgently needed, is a coherent strategy embodying well-defined goals including the attainable niches for Canada; and a consistent set of public and private-sector policies to enable the microelectronic technology to flourish, and thereby extend its full advantages, to the Canadian people.

In the process of adaptation, different actors will have to fulfill different responsibilities. In order to create a hospitable environment for investment into technology serving people, a number of steps are required mainly by the federal government. The following list is by no means all exhaustive, but it should serve to highlight the areas where attention is needed urgently.

These steps would include: 1) a clear and unequivocal signal and commitment of the federal government that the high technology industry is a national priority; 2) a healthy and positive environment for private sector investors, including the elimination of tax disincentives, reductions or indexation of the Capital Gains Tax, to respond to the risk capital needs of technological entrepreneurs; 3) the creation of new information infrastructure institutions such as a Junior Industrial Exchange like the Toronto Stock Exchange to facilitate the investment process; 4) the rationalization, streamlining, up-dating, and making more efficient and quickly deliverable, government assisted policies and programmes to cultivate a Canadian-owned, world-class competitive high technology industrial sector. This would include simplifying the administration of the Income Tax Act, Revenue Canada's positive treatment of research and development (R & D) incentives; 5) the use of government procurement and encouragement of private sector procurement to bring Canadian-owned companies to volume production; 6) the investment of government funds in areas of strategic technological development which have a time horizon greater than three years. When a government-developed technology attracts the attention of the private sector investors, it could then be transferred to Canadian-owned companies to commercialize; 7) ensure that companies receiving any form of government assistance or encouragement do comply with the spirit and intent of the recommendations sensitive to peoples' concerns made in this report.

What is also vital, to the success of this approach is the creation of an independent body, a Canadian Centre of Technology,

Work, and Human Priorities -- facilitating on a full-time basis, job creation for community development, research, promotion and application of technology keeping social and human priorities in the forefont. This body, to be made up of representatives of labour, industry, government, special interest groups and educators, should report directly to the Parliament of Canada. The multi-faceted and many dimensional issues related to technology and its implications are so broad in scope that the productive resolution of societal issues will require an open environment in which it will be possible to develop appropriate balances among the frequently competing industrial, economic, and social goals of our country. This is not the task of existing departments and agencies pursuing their broad policy and programme mandates, of which micro-technology is but a component, often at cross purposes with each other, frequently in spite of the processes of coordination handled by one or more central agencies.

In addition to providing much-needed full time attention, this body would furnish another, equally vital service. As we envisage it, this Centre would provide a fresh forum for co-operation betwen major economic decision-makers: industry, labour, and governments; departments, agencies, or super-ministries do not, by their very nature, lend themselves to such a possibility. Being independent, this forum will offer the participants the opportunity to bring forward their ideas, act as countervailing forces with a view to arriving at a consensus bearing in mind that in order to augment productivity, technological developments must make peace with human and social concerns of the people of Canada.

The raison d'être of this Centre should be to achieve and maintain an effective balance between Canada's urgent need to adopt the most up-to-date technologies for economic growth and the concomittant responsibility to ensure that technology serves our collectivity, and not the other way around. The Centre's mandate should thus rest on three main functions: job creation, public information and research, and monitoring. As a national body, having access to the major interests in Canada, the Centre should assist the Federal government in the development, promotion, and implementation of a comprehensive Canadian information/microelectronics technology strategy for the general advantage of Canada. In order to accrue the most benefit for Canada, emphasis should be on the development of the Canadian supply of products and expertise, giving preference to firms owned and controlled in Canada by Canadians, and encouraging high technology industry in every community in Canada, -- augmenting assistance to small and medium-sized microelectronics business willing to locate in economically depressed communities throughout the country.

Furthermore, this Centre should be the central focal point -- carrying out public awareness programmes to ensure better appreciation of the need for, and the acceptance of microelectronic technology. Such educational programmes should, as their integral element, stimulate public

understanding of the role of labour, industry, governments and special interest groups, in technological change. A further critical element of this awareness programme must be to inform those who might not be able to learn new skills, to adapt to new work requirements that various public and private services would be available to assist them through the period of transition, and where these services would be available.

The Centre should, as a part of its duties, carry out short- and long-term research into the impact of technology on the productivity of all economic sectors, conducting in-depth, sector-by-sector longitudinal studies on the number, and the nature of jobs created, or lost due to the introduction of high technology. In view of the changing perceptions towards work, it should carry out innovative pilot projects on redefining work, experiment with, and design new work structures befitting the twenty-first century, and determine new methods of compensating both men and women for all types of work. On all of these and related activities, the Centre should publish periodic assessment reports.

In its monitoring capacity, the Centre should liaise with international organizations such as OECD and International Labour Organization (ILO), and take the necessary actions to help fulfill Canada's commitments to the Centre Mondiale d'Informatique et Développement des Ressources Humaines in Paris and the Versailles Summit. It should also remain abreast of all international research in this field, make that information available to the interested parties in Canada, and encourage an exchange of views and information on a continuing basis. Further, the Centre should monitor the supply and demand side of training and advise Canada's educational system accordingly. Lastly, the Centre should be responsible for monitoring the implementation of the recommendations contained in this document and report on the progress thereof annually to the Parliament of Canada.

Technology for People

We are the first generation to face the end of the industrial revolution, and to define the values and structures of the new economy. The object of our attention is the information technology. Microelectronic technology is here to stay. To resist it would be counterproductive. Our economy does not offer this luxury. With imagination, perseverance and sensitivity for people, we should be able to determine our place in the future world economy. We need one policy centered on two imperatives: placing the growth of the economy in general, and the information sector in particular, at the top of our priorities -- in harmony with the only possible corollary objective: well-being of workers as well as citizens of this land.

B. Microelectronics and Work

It is inevitable that microelectronics, a truly transforming technology, will bring new industries into existence and render others obsolete, and thus will at once create and displace different jobs. For example, the computer industry has grown at an annual rate of 25 per cent, doubling every three years. The office automation and industrial robotics industries have grown even faster, at the rate of 35 per cent, doubling in only two years. In the process many new jobs have been and will be created. However, within the past several years we have heard new concerns over the issue of "technological unemployment" from people who propose that the dire predictions of the 1950s will come to us in the 1980s, and that they will come with a vengeance -- because we have not prepared for this wave of new automation.

What is the situation? Do public policies need to be developed in Canada to meet the challenge which the new technology presents in terms of employment issues? Is there historical evidence to suggest that, except for short-term, often serious, dislocation, technological change leads to economic progress and increased employment? Or, is the reverse true -- that automation will lead to inexorable reduction in the number of available jobs and increase the rate of unemployment?

The time when Canada's unemployment rate has risen to the highest level since the Depression is hardly the best of times for examining the employment implications of the new technologies. Conventional wisdom in the policy making community has been that technological change increases prosperity over time, and that it does not necessarily lead to unemployment. An opposing view, supported by specific evidence, has been held over the years by groups who maintain that technological progress has led to transitional, if not permanent, unemployment. These views have always intensified whenever the economy slowed down, or whenever a new wave of technology arrived.

The convergence of the current recession, accelerating unemployment, and the third technological era -- with microprocessors being dramatically cheaper, relatively more powerful, and much more reliable than the large computers of the past -- has given new impetus to the long-standing discussion.

Polarization of Views

As already noted, given the impact of technological change on employment and the context in which it is occurring, two quite different views have evolved as to whether such changes are positive or negative. One, pessimistic, view might be called "massive unemployment" (mostly, but not exclusively, a Western European concern); the other, a "business as usual" or optimistic view (primarily a U.S. and Japanese position).

The perceived problems of massive unemployment resulting from the third technological revolution haunt the pessimists. According to their views, the job decrease is directly attributable to microelectronics, as this new technology by and large does not create new jobs or services, but

only increases productivity, destroying jobs. It is the office workers, mostly women, who have to fear the new technology more than their blue-collar colleagues. The pessimists do not expect a sufficient number of new jobs to be created in the information technology industry to compensate for the losses in other sectors, because this area also will be heavily automated.

The optimist school of thought, on the other hand, believes that the effect of technological change on employment is very difficult to measure. The employment effects are indirect and diffused because technological change does not take place in isolation. Technological changes interact with, and are modified by, other factors that affect employment, such as changes in output, consumer tastes, and international competition. There is, however, abundant evidence in the last three decades to indicate that as long as the economy has expanded and demand increased, steady technological advance has been compatible with rising employment.

Within this view, the negative impact of the microprocessor on white collar employment has been discounted. The optimists conclude that the belief that the increasing use of the microprocessor could cause wide spread unemployment may be totally erroneous; -- microelectronics will create more jobs than it will destroy, resulting in a net gain rather than a loss of jobs in the economy as a whole.

This polarity of views has been also reflected in our hearings and briefs. Almost exclusively, the employer groups -- Employer's Council of British Columbia, British Columbia Telephone, Canadian Manufacturers' Association (CMA), Bell Canada, Canadian Pacific and the Canadian Banker's Association -- considered that "while there are undoubtedly some ill side-effects of the revolution, it must be realized that some short-term ill effects are more than offset by long-term benefits." More specifically the prevailing view was along the lines that "we would rather examine the ways and means of making Canadian industry more competitive, instead of dealing with ghosts and shadows of alleged problems that might exist at some future time." Their presentations usually concluded that to this point there has been no massive disruptions in the existing labour force caused by the introduction of microelectronic technology.

On the other hand union spokespersons -- Communication Workers' of Canada, CUPE, National Union of Provincial Government Employees, Alberta Federation of Labour and United Steelworkers of America in particular -- returned constantly to the general theme that "if we do not provide our members with an awareness and tools needed to deal with this challenge effectively, we will surely be beaten by this looming threat to our employment, income and way of life". Targeted jobs, particularly in communications were stressed, and lists and tables of employment effects, both potential and already happening, were noted frequently.

This sharp polarization of views indicates that no consensus exists on the question of the net

job balance created by the development and expansion of the new technologies. To date, there has been no serious effort, over time, to determine the possible effects of even one aspect of the new technology -- of microprocessors -- on employment totals. Such an analysis would have to include not only the direct net employment effects but also the effects on the infrastructure of the technology, on companies connected to new technology by forward and backward linkages, on the general form of employment associated with the provision of services to all enterprises, and on employment derived from expenditures or incomes earned by all the factors of production participating in the technological change. Most forecasts to date relate only to the effects on the infrastructure of the technology and on companies connected to the new technology which have been extrapolated to the whole of the economy.

To sum up, the most contentious question whether microelectronics destroys more jobs than it creates could not be answered by this, or, for that matter, by any task force with certainty at the present. What we could do, was to reflect on the range of views presented to us, make some observations about the nature of the technological unemployment debate and on the paucity of data, and suggest some approaches to dealing with the practical implications of these unemployment concerns.

Pitfalls of Extrapolation

In general, our reaction to what we have heard and examined leans toward cautious optimism. Extremely pessimistic forecasts of technological unemployment would appear to be most likely wrong. Productivity gains and thus specific job losses noted with respect to some local technological changes cannot be automatically extrapolated to the whole economy. Furthermore, in a stagnant economy, the diffusion rates of the new technologies have slowed down, indicating that a key assumption of the pessimistic forecasts regarding a simultaneous occurrence of no economic growth and fast diffusion rates seem to be wrong. The growth of world trade -- growing traditionally at twice the rate of growth of national economies - has declined in recent years, suggesting perhaps that developments in one country will have less of an effect on the rate of technological change in other nations than previously. Paradoxically, then, the present slowdown in the world economy provides us with the time for a more orderly adjustment to the new world of the chip.

The growth of new jobs in the microelectronics industries will have at least a partial offsetting effect on the unemployment statistics. These new positions might preserve or even increase employment in some areas. The 1982 review of national experiences with microelectronics, produced by the Organization for Economic Co-operation and Development concluded:

> "on the basis of national projections in the countries reviewed, a rough estimation of the average outcome is that 60 per cent of the direct technology-induced reduction of labour demand will be offset by 1990, excluding effects stemming from

international competitiveness (which could further increase employment in some countries but not in the international trading community as a whole)."

If extremely pessimistic forecasts are most likely wrong, so are the extremely optimistic ones. Experience in Canada and other countries, as well as presentations made to the Task Force, suggest that there might indeed be problems in generating enough new employment to compensate for possible short-term job displacements. In the short term, in a recovered economy, microelectronics could conceivably create an imbalance in the labour market, bringing to it a certain degree of disorder and uncertainty. What is worse, some structural unemployment might result -- the new jobs which are being created can not necessarily be staffed by the people who have been displaced by technological change.

The skills needed for the new jobs are entirely different. On one side, microelectronics creates new jobs for people such as systems analysts, programmers, software researchers and designers, and data analysts. These positions require high qualifications. The hardware area needs skilled people with an electrical engineering background to design the chips and their applications, whereas the software area is booming with openings for those who understand control, production and operational systems.

On the other hand, microelectronics affect many sectors of the economy and thus cause diverse positions to disappear or be modified. For example:

- Clerical workers, mainly women, whose jobs are linked to stock taking and classification of information may find their positions being eliminated or transformed;

- Typists, almost exclusively women, may have their typing functions significantly reduced and other functions could be integrated into word-processing operations;

- Secretaries, nearly all women, may become executive secretaries, with typing and clerical tasks being replaced by functions like preparing information, counselling, and performing administrative tasks;

- Telephone operators, predominantly women, may have seen reduction of jobs as a result of technological advances in new systems which coincide with the need for executive and higher-level clerical workers;

- Bank tellers, the majority of whom are women, whose role as bank-customer relations will likely be reduced by automated teller machines from a central to a more supporting one. The number of tellers employed might be cut back substantially once personal access cards gain widespread acceptance. However, it will not be possible to chart the demise of the teller, since the job

title is already disappearing into other titles such as "customer service representative" or "administrative support". These new job descriptions include functions such as resolving customer complaints, promoting and selling banking services, and related counselling. The core of the work is changing, creating a more professional information worker.

It has to be stressed that the destruction or creation of positions does not ipso facto translate into the destruction or creation of jobs. The phenomenon of job transfer intervenes, which in numerous cases permits the economy to adapt itself without too much damage. This is true at the level of the corporation, where some permutation is always possible between certain categories of workers. It is also true at the production sector level, within which the changing competitive position of individual companies produces a redistribution of workers (when better placed companies hire away part of the displaced labour of troubled companies). This scenario is true also at the global level of the economy, in which transfers of employment occur between dynamic and recessive sectors. Such transfers often happen, however, only after some retraining.

It is difficult to forecast where the personnel whose jobs were eroded will be rehired. Similarly, it is difficult to forecast who will occupy the newly created positions. We would need studies on labour mobility in general, and the types of mobility offered by individual jobs, to arrive at realistic forecasts.

It may be that, in particular sectors, the often feared phenomenon of "jobless growth" will be encountered -- i.e. growth in output that is not matched by a significant increase in the jobs directly associated with that growth. The term "jobless growth" is, however, another perhaps more attention-getting, way of saying "major productivity improvement". This term, however, implies that the impact of such growth on demand in the total economy can be ignored. However, as is well known, the increased demand has a considerable job creation effect. Thus, increased productivity in one or more sectors is unlikely to have effects similar to "jobless growth" across the board. Unfortunately, we cannot infer by studying individual segments the way the economy as a whole will develop, and how work and income will be distributed in the future.

Will the progress of automation be reflected, as in the past, by further reductions in working hours, with a maintenance or even increase of earnings -- as occurred when industrial economies moved from 60 hour work-weeks to 48 hours, and then to 40? What seems obvious is that society is not likely to give full support, nor is the economy likely to sustain, a drive for productivity-based growth, unless benefits of increased productivity are clearly seen to be shared by the workers in the affected industry, and to have positive consequences for all Canadians in the form of a newly planned economic base capable of generating revenues for social expenditures.

We are persuaded by our current research, by our consul-

tants' analyses, and by presented briefs that historically, as well as more recently in an expanding economy, technology has created enough new employment opportunities to enable societies to adjust to technological-economic changes within reasonable periods of time. Whether this will persist as a pattern in the future is not clear. The onus of proof that the historical effects of technology on the availability of jobs will now be radically different must lie with the proponents of this new thesis. Since the debate will not be conclusively terminated until the historical record of the microelectronic changeover is complete, we believe that practical policies must be geared to the processes of adaptation rather than towards attempts to address narrowly-defined, untenable predictions about employment.

Consensus with Caution

It needs to be pointed out that the net employment issue, however clouded, does not detract from a fairly broad consensus on that specific changes in jobs, in the mix of jobs, and in the areas where opportunities exist.

Areas of consensus have indeed emerged both about job creation and job destruction.

Some agreement appears to exist on the extent of potential job destruction in very specific segments of the labour market. In addition to the concerns about new entrants to the labour force, the situation could be most severe for older workers, who have less flexibility in retraining, re-education, and relocation, as well as for the lower-level skilled labour force. Within management, middle managers are expected to be the hardest hit.

Overall, however, it was stressed to us again and again that women, who now constitute the bulk of information manipulators in the service sector, might well bear the brunt of the impact if it comes as predicted in the pessimistic scenario. Women are particularly vulnerable because they are clustered in a few job ghettos, such as clerical, sales and services. These jobs generally offer low wages, little job security, and poor benefits, if any. They are also the jobs which are in the front line of the efficiency and higher productivity drive through technology. Furthermore, they are largely non-unionized and hence outside the powerful influence of union leaders, thus being denied the fruits of the collective bargaining process. Finally, the existing skills of many female workers may not be those that will be needed in the future. Burdened by dual tasks -- family obligations and job responsibilities -- it is often very difficult, if not impossible, for women to avail themselves of new and advanced skill training.

It is the view of some observers that the unemployment of women in the service sector, caused by new technology, is partially masked; i.e., it is considered to be greater than it appears to be at first glance. The argument is that there have been no massive lay-offs of clerical workers or other service workers, beacause the reduction of staff in most of these areas -- such as banking, telephone, supermarkets -- are usually handled through attrition. Commentators point to the trend that women are inclined

to move in and out of the labour market much more frequently than men because of family and child care responsibilities, or because of changes in their husbands'/covivants' jobs, or perhaps in an attempt to leave low paying and dead-end jobs behind. Furthermore, commentators feel that this high turnover in women's jobs allows employers to reduce the number of clerical and service workers they employ, without having to resort to layoffs. This method of reduction through attrition means, so the debate goes, that the number of jobs lost at any one time tends to be small. The increasing levels of unemployment flowing from the application of new technology in the service sector tends to be ignored mainly because women's work is still considered by many to be of secondary importance -- despite the fact that most women work for pay out of economic necessity.

On the other hand, many observers also agree that with increased productivity, employment in the service sector might actually continue to grow, as new services emerge. It is also believed that more jobs could be created in "quartenary manufacturing" of goods such as computer games and devices that can be used in a "self-serve" manner in such areas as education, medicine, recreation, and entertainment.

The resolution of these kinds of uncertain and conflictual statements did not come easily to Task Force members. Nor will it come easily to those responsible for determining public policy. However, we firmly believe that a number of preventative steps can be taken to encourage a problem-solving orientation. Our whole approach, therefore, has been conditioned by a concern for effective processes that will promote flexibility and adjustment to change, coupled with training and educational emphases that will better prepare individuals for effective entry and development in the new labour markets.

C. Industrial Relations

The industrial relations system can play a crucial part in meeting the challenge presented by technological change. Whether or not the system meets that challenge will largely depend on the positions of the participants. Management and employees can build a climate of cooperation to allow for a smooth and humane movement toward economic growth. Or they can approach technological change from perspectives which will inevitably and counterproductively result in mistrust, frustration and social unrest.

This Task Force supports the underlying concept of the Canada Labour Code - that is, the concept of free collective bargaining as the most appropriate method to assure worker participation in the establishment of good working conditions. In addition, we support the view that the intention of any legislative provision designed to deal with technological change ought to be to motivate the parties to discuss and reach agreement on ways to minimize the negative employment effects of technological change.

Canada as a whole has a stake in the effectiveness and efficiency of provisions designed to deal with the introduction of technology. Society has already assumed many responsibilities for financial and social support systems for people displaced by change. Therefore, society can properly expect to receive some assurance that management and labour will discuss and come to mutually beneficial agreements on how technological change will be introduced. It is in this context that we see room for legislative involvement.

This Task Force accepts, as a fundamental premise, the need to encourage and support the continued development of our high technology industries and the diffusion of their products and services in the Canadian economy. The Task Force also recognizes, as a fundamental premise, the changing social needs, values and expectations that have been evolving in Canadian society at least since World War II. These social needs, values and expectations must be taken into account if technological change, especially one as important in nature and scope as microelectronics is, to be successfully implemented. It is very difficult to utilize new technology efficiently in an atmosphere of confrontation and agitation.

We believe needless social unrest would indeed occur if companies and their management repeat the mistakes made by the Canadian Post Office during its first phases of postal automation in the late 1960s and early 1970s.

The Effect of Changing Expectations

There are several key changes in social expectations and values that influence the environment in which current discussions on the implementation of technological change will proceed at the level of the undertaking. The Task Force draws particular attention to the following:

1. The emergence of a basic distrust of unlimited authority which tends to challenge the scope of "managerial prerogative". A wider notion of social accountability and responsibility now defines our expectations of business and

labour. The submission of Canadian Pacific Ltd. acknowledged this change in pointing out that those planning new systems must see that workers are well informed and that they are helped to a successful transition from the old to the new.

2. The acceptance of a greatly expanded concept of individual and group entitlements and rights, combined with the creation of new institutional forms that immensely shorten the time span between the individual's sense of entitlement and political action. In Canada, three fairly recent institutional developments come to mind to exemplify this change: the creation of the Canadian Human Rights Commission (1978), the Charter of Rights and Freedoms proclaimed as part of our newly repatriated Canadian Constitution (1982) and the Freedom of Information legislation passed during the spring, 1982, session of Parliament.

3. A growing emphasis on self, self-actualization, and self-determination is developing. Within unions, this will find expression in greater rank and file direction of collective bargaining; between unions and management, in greater demands for some form of "industrial democracy"; and within management, in greater experimentation with alternate leadership and organizational styles.

4. A growing awareness is now evident that productivity growth (however that is defined economically) is as vital to workers as it is to management. Sustained rapid growth of productivity requires the active cooperation of the work force. Research has shown that this cooperation is largely dependent on labour's perception of management's attitude toward its employees.

This attitude was expressed to the Task Force, by, among others, the Canadian Manufacturers' Association which noted the desirability that all major actors (employers, unions, governments) cooperate in the introduction of technological change so that all segments of society will benefit and employees will be assured they are treated properly.

This Task Force agrees with the Canadian Manufacturers' Association that what is needed is active, continued cooperation. However, we are mindful of the reality of the collective bargaining system which is based on the notion of adversaries making gains determined by their relative economic strength.

Legislative Treatment of Technological Change

One of the specific directives to this Task Force from the Minister of Labour, the Hon. Charles Caccia, was to assess the adequacy of the Canada Labour Code as it applies to technological change. We considered Part V, Sections 149-153, Part III and the recently enacted Labour Adjustment Benefits Act (Bill C-78).

In carrying out this portion of our mandate, we considered all of the references to technological change and industrial relations contained in submissions presented to us. We commissioned a research report on this subject and considered the views of other experts. Our policy orientation was shaped by this varied input.

Our public meetings and the submissions we received, immediately revealed that it is on the subject of legislative framework, that the parties are most sharply polarized. Organized labour was in unison in its argument for more active legislative involvement in technological change. Employers just as strongly held to the view that the current framework is adequate and ought not to be changed.

Labour believes that the impacts of microelectronic technology on workers will far surpass that of previous technological change. Hence, the Canadian Federation of Communications Workers told us that new legislation is needed to require companies to consult unions when introducing technological change. They noted that this had been recommended by the Carrothers Commission. Similarly, the Canadian Union of Public Employees stated that changes to the Canada Labour Code concerning the right to effectively negotiate technological change were long overdue.

Employers do not consider that changes occurring as a result of the diffusion of microelectronic technology are significantly different from changes which have occurred in the past.

Bell Canada, the British Columbia Telephone Company, the Employers' Council of British Columbia and the Canadian Manufacturers' Association among others, all told us that they perceive no need to change Part V of the Canada Labour Code.

While the Task Force is of the view that the economic benefits of technology and its potential employment effects demand that improvements be made to our legislative treatment of technological change, we would like to emphasize that legislation alone will not assure smooth adjustment to change. Rather it is the commitment, imagination and motivation of the parties which will contribute the most to the successful implementation of technological change.

In addition, to the general criticism of the legislative framework provided by Part V, five recurring criticisms relating to particular features of the current legislation were presented by organized labour, women's groups, and others.

These specific criticisms were also mentioned in the first decision (Ottawa-Carleton Transit, 1982) of the Canada Labour Relations Board (CLRB) on the technological change provisions. In this case, the transit authority planned to introduce a computerized scheduling and traffic control system. Information about its plans were communicated to the union shortly after the signing of a two-year collective agreement. The union was concerned about the proposals, since it foresaw a loss of jobs if the employer plans were implemented. It filed applications to the CLRB to (a) find that the employer had failed to give proper notice, and (b) give permission (to the union) to serve notice to bargain. The CLRB summarized the positions of the parties. The employer argued that (a) the proposals would not affect a "significant number" of employees, that is, ten per cent of the workers in the employer's view; (b) changes in job descriptions do not constitute technological

change; (c) it had been unaware of the Code provisions until it learned about the union's complaint, and (d) the CLRB should exercise its discretion not to issue any order.

The Union put forward the arguments that (a) the potential impact of the proposed changes went beyond changes in job descriptions, (b) a significant number of members would be affected substantially and adversely with respect to the terms and conditions of work, and (c) bargaining should occur before the proposed changes were put into effect.

The CLRB decided not to permit collective bargaining immediately, finding that no real discussion had yet taken place between the parties. It reserved the right to allow notice to bargain at a later time, should informal discussion between the parties over their respective concerns not prove fruitful. (Ottawa-Carleton Regional Transit Commission and Amalgamated Transit Union, Locals 1502 and 279, 1982, 1 Can. LRBR 172.)

The following legislative shortcomings are implicit in this decision and were repeated time and time again during our meetings.

Firstly, the current provisions are considered to contain several examples of ambiguous language. Phrases such as "substantially and adversely affect" and "significant number of employees" were singled out in many briefs as seriously undermining the usefulness of the provisions. These phrases leave the parties uncertain about whether or not they are in a situation which allows them to compell negotiations on technological change.

Secondly, the statutory definition of technological change is seen by many to be too restrictive. The wording of the definition of technological change is a vital aspect of the current legislative scheme. Only that activity which clearly comes within the definition will trigger the requirement on employers to give notice of change. Furthermore, it is only with respect to that activity that a trade union can begin the process to compel an employer to recommence bargaining. Dissatisfaction with the present definition is based on two concerns:

(a) The definition does not cover all types of changes in the manner in which work is carried out which may be the result of an introduction of technology; and,

(b) the definition requires a trade union to prove too much before being able to activate the process leading to a recommencement of negotiations. The union must not only show that the employer plans to introduce new equipment or material, but also that there will be a change in the manner in which work is carried out, and that the particular change is directly related to the introduction of new equipment and material. Given the level of information on which the union may have to rely during the crucial period prior to the introduction of technology, it is argued that the definition inhibits rather than encou-

rages the possibility of meaningful and timely negotiations.

Thirdly, Section 149(2) is considered unsatisfactory. This section relieves an employer of the statutory obligation to give notice or to recommence bargaining in the following circumstances:

(a) if the employer gave notice of a proposed change in time for it to be considered prior to concluding the last agreement;

(b) if the collective agreement contains provisions which allow for the settlement of matters pertaining to terms and conditions of employment, or security of employment, that might be affected by technological change; or

(c) if the collective agreement contains some provisions intended to assist employees adjust to the effects of change, and the agreement specifies that the statutory provisions do not apply.

These "opting out" provisions are seen to greatly weaken the overall thrust of the technological change legislation. The scheme was established to encourage the parties to anticipate the possible effects of technological change and to engage in negotiations designed to ease negative effects. Parties who do develop provisions in anticipation of technological change, may do so without adequate information about an imminent change and therefore without any notion of the full implications of the change which subsequently occurs. Yet these same anticipatory provisions may prove to be the sole but inadequate definition of the parties' responsibilities. So the irony of the scheme is that parties who honestly try to deal with the issue in an anticipatory way may be bound by agreements rendered obsolete by the unfolding of events.

Fourthly, trade unions among others were unanimous in their view that the 90 day notice provision is inadequate to allow sufficient time for the union to gather information and formulate proposals concerning mechanisms to deal with the effects of technological change.

Fifthly, repeated criticism relates to the inadequate level of information provided by management about its plans to introduce new technology.

Effectiveness of Current Legislative Scheme

The Task Force feels that several of these criticisms are well founded. In some cases, it seems clear that the language of the provisions in Part V of the Canada Labour Code has been relied upon to limit a union's ability to compel negotiations on an unwilling employer. It is unlikely however, that these provisions have stood in the way of parties determined to come to agreement on technological change. There lies the crux of the problem. Outmoded and counter-productive notions of managerial prerogative combined with a generally reactive union policy stance in relation to technological change have probably contributed a great deal more to the present state of bargaining on this issue than the wording of Part V of the Canada Labour Code.

A workable indication of the present state of bargaining in the area of technological change is provided by statistics compiled by Labour Canada. These statistics (see Appendices) show that the majority of agreements in the federal jurisdiction contain neither procedural nor substantive provisions on technological change. Seventy-two per cent of these collective agreements make no provision for prior notice of a technological change. A much higher percentage of collective agreements have no substantive provisions for adjustment to change, such as training, retraining, relocation allowances, work-sharing or labour-management committees.

These data question not merely the adequacy of the current legislative language, but also and perhaps more importantly, the appropriateness of the largely permissive approach taken to technological change. This approach as disclosed by the Part V provisions was designed to alert the parties to the importance of this area and to encourage them to negotiate on the range of employment issues which flow from an introduction of technology. The fact is that the legislative scheme does not seem to have greatly influenced that result.

We are not in a position to provide an exhaustive list of the factors which might account for the absence of technological change provisions in collective agreements. We do, however, suggest several possible explanations.

In some cases, the parties have discussed and come to agreement on technological change outside the course of normal collective bargaining. These situations would not be captured by the available data. Another possible explanation stems from the ordinary trade-offs implicit in negotiations which may result in a willingness to forgo contract gains in this area, especially if there is no expectation of imminent change, in favour of more tangible monetary advantages. The current tendency toward contracts of shorter duration may mean that the life of agreements, and the time-span between one series of negotiations and another, serves to reinforce decisions to delay serious negotiation on technological change.

This Task Force is convinced that technological change can only be successfully and beneficially adopted by employers if it is done in the context of careful, ongoing planning and consultation with workers well in advance of the introduction of new technology into the workplace. This context is not always compatible with the often highly charged and time-pressured bargaining arena.

We have come to the conclusion, based on public policy developments in selected Western European countries, the findings of several previous Commissions on industrial relations and technological change, and our experience over the past 10 years with the technological change provisions of the Canada Labour Code, that collective bargaining may be an inadequate instrument to deal with technological change.

Our review of policy developments elsewhere discloses a stronger regulatory trend in the area of technological change than

is now evident in Canada. Employers are generally required to provide more detailed information and to engage in consultation with their employees prior to the introduction of a change. The mandatory creation of bipartite committees operating at the level of individual establishments to help plan for change is a common feature of the regulatory schemes we reviewed. Most schemes make provision for dispute settlement, and many include a requirement to provide compensation to displaced workers either through a wage settlement on lay-off plan or through the establishment of a general redundancy fund.

Several scholars and experts in the field of industrial relations have been called upon by federal and provincial governments over the past 20 years to conduct studies of various aspects of Canada's industrial relations system. The findings of those studies are as pertinent now as they were when they were submitted. For example, the Woods Task Force appointed by former Prime Minister Pearson recommended in 1968 that no less than 6 months' notice be given in advance of the introduction of a technological change to allow for adjustment to change.

In addition, the results of our 10 years of experience with the current legislative approach suggests that a permissive approach confined to the bargaining arena is no longer sufficient. Our analysis of collective agreements shows that technological change has not emerged as an area to be covered by collective agreement as frequently as would have been expected. That result provides at least one useful measure of the effectiveness of the current legislative scheme. In our view, it has not been successful in achieving that which it set out to do - to encourage the parties to bargain.

Further, a stronger consideration leads us to the view that a revision of Part V, even a significant revision would not suffice.

The provisions of Part V have no direct application for the majority of Canadian workers. Most Canadian employees, many of whom are women facing vulnerable work prospects, are not unionized and hence are not protected by a formal bargaining structure. It seems apparent to this Task Force that this is a fact that policy-makers in this area cannot ignore. The goal of labour policy has at least two dimensions: to foster an industrial relations environment which anticipates the effects of technological change, rather than reacts to it; and to assure that the effects of technological change, are anticipated for all workers, not only the unionized.

Our recommendations for change to Part III and Part V of the Labour Code are put forward with this goal in mind.

In response to the many concerns addressed to us regarding the definition of technological change, we recommend that the definition be amended to assure that discussion is activated as soon as management proposes to introduce any new equipment or material which could affect, either directly or indirectly the working conditions or job security of any employee. To assure that timely measures designed to ease the negative effects of a technological

change on the employment of all workers are taken, we recommend that a minimum standard be introduced to Part III of the Canada Labour Code. This standard should apply to all employers of 50 or more employees and should require:

(a) the provision of at least 180 days notice of technological change; and

(b) the establishment of bipartite committees composed of representatives of employees and employers. These committees would create an identifiable center within the undertaking to direct and engage in ongoing consultation and discussion in anticipation of technological change and to develop adequate adjustment plans to meet the potential negative effects which might flow from technological change. In making this recommendation, we have been guided by the precedent set by Joint Planning Committees, established under the Labour Adjustment Benefits Act. However, the effectiveness of committees created to tailor and guide the process by which technology will be introduced, and to anticipate and deal with the needs of employees will depend on a clear statutory definition of the powers and functions of the committee. While the Labour Adjustment Benefits Act has provided the precedent for these committees, we emphasize that the work to be performed by them contemplates a much more expansive role than has been assigned to Joint Planning Committees.

(c) that disputes concerning the power and functions of the committees or the adequacy of proposed adjustment plans be submitted for resolution by binding arbitration. Arbitration should be provided by the Minister of Labour at the request of either the employer representatives or employee representatives of bipartite committees.

Before concluding our comments on the Labour Code we would mention that, as our work in the area of labour legislation progressed, it became clear to us that the Canada Labour Code and the Labour Adjustment Benefits Act would profit from an overall review designed to rationalize and integrate these provisions under one statute dealing generally with worker protection and the working environment.

The Labour Adjustment Benefits Act, which was passed by the House of Commons on February 22, 1982 and proclaimed in force May 1, 1982. It is an extremely complex piece of legislation which has not yet had time to be tested in practice. The legislation is designed to reduce financial hardships experienced by laid-off workers from industries designated by the federal government.

From the point of view of our mandate as a Task Force on Micro-Electronics and Employment, the Act has one overriding aspect which severely limits its use in aiding workers made redundant or laid off due to the introduction of microelectronic technology to their workplaces. Section 3(2)(a) defines the parameters for designating an industry under this

act. For our purposes the operative phrase is "... by reason of import competition or by reason of industrial restructuring implemented pursuant to a policy or program of the Government of Canada to encourage such restructuring ..." Technological change by itself, even though it might be part of industrial restructuring, is not a reason for designation. Technological change is not excluded by this legislation, but it would have to occur in industries designated for either of the two reasons cited in the Act.

Therefore, the provisions of the Act do not seem to adequately address the needs of workers affected by microelectronic technology. The Task Force received only a minimal amount of input on this Act. As indicated earlier, it became effective only recently. Since this legislation has been in effect for such a short time, it is the view of the Task Force that sufficient time should be allowed to monitor the Act before amending or changing it.

D. Quality of Working Environment and Work

In the last decade, increasing numbers of employers have attempted to develop management policies which integrate social and humanistic values with economic and efficiency imperatives. These policies are intended to create a working climate in which employees derive psychological satisfaction from their work, and hence motivate themselves to help their firm reach its productivity and profitability objectives. Quality of working life programmes in which workers participate in decision-making concerning their own activities, including ensuring a safe, healthy and secure workplace, design and organization of their work and the scheduling of their work time, are fundamental to these new management policies.

How does microelectronic technology affect the quality of work and of working life?

The information presented to the Task Force reflected sharply divergent views on the effects of chip technology on work and the quality of working life. According to CP Ltd., new office technology has had a positive impact on office employees; for example, machines' editing capabilities make it easier to learn new "keying jobs", reduce monotony, and thereby increase job satisfaction. Similarly, a study of the banking industry, commissioned by the Task Force, reported that as a direct result of automation, tellers' jobs have become more varied and interesting.

Other submissions presented a different view. For instance, the Canadian Federation of Communication Workers, whose members, predominantly women, operate Canada's telephone system, stated that in addition to threatening jobs, computerization caused work speed-up, tighter supervision and hence a more oppressive working environment for the operators. The Canadian Air Line Employees' Association also felt that technological change has reduced the previously varied functions of passenger agents to simple information retrieval.

Public meetings, briefs and other sources revealed three main concerns related to the impact of chip technology on the quality of working life: health and safety issues; the downgrading of jobs through the alteration of job content, social isolation and electronic monitoring, and the organization of work time that may become detrimental to the workers and thereby defeat technology-driven productivity goals.

The obvious ingredient for achieving high levels of productivity in any organization is the harmonious integration of workers, procedures including equipment, and the working environment. If workers are preoccupied with worries about their career prospects, on-the-job health and safety, whether physical or mental, productivity will suffer. This axiom is basic to the Task Force's approach to its deliberations on the quality of work and the work environment.

(i) Health and Safety

> "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." (Definition of Health,

Constitution of the World Health Organization).

"... health in relation to work, indicates not merely the absence of disease or infirmity; it also includes the physical and mental elements affecting health which are directly related to safety and hygiene at work." (Convention 155: Occupational Safety and Health and the Working Environment, International Labour Organization: June 1981. Canada supported the adoption of this instrument).

Questions and concerns about the occupational health and safety aspects of microelectronic technology were expressed in almost all submissions to the Task Force and examined in our own research report. During our public meetings these concerns were reinforced. Four interrelated questions quickly emerged:

1. Are visual display terminals (VDTs) a radiation hazard? Do they emit any kind of radiation - X-radiation, microwave radiation, ionizing radiation, very low frequency radiation - sufficient to endanger health?

2. Are there other symptoms of ill health that can be directly attributed to work with microelectronic equipment, especially VDTs?

3. Are there special ergonomic considerations for microelectronic workplaces, especially VDT workplaces, that could alleviate health concerns?

4. Are there quality of working life (QWL) considerations that could be promoted for microelectronic workplaces, especially VDT workplaces, and could further help promote health in the workplace?

In recent years, VDTs have come to be used increasingly in our workplaces and in society. Their manyfold increase has spawned a growing concern about the potential effects the use VDTs has on the health and well-being of their operators.

Not surprisingly the area of greatest concern in the submissions to the Task Force focused on the potential effects of low-level radiation emission from VDTs. It should be remembered that various types of radiation have the potential to cause problems including cataracts, cancer, genetic damage, blood disorders, premature aging, birth defects and miscarriages. This concern has also been expressed in sensational stories in the media, and repeated at countless conferences as fact. Currently the gravest worry is that radiation from VDTs is the cause of an unusually high incidence of miscarriages, and/or children with birth deformities born to women, who during pregnancy, worked with VDTs. To date, several such "clusters" of reproductive problems have been reported in North America.

Extensive research has attempted to measure radiation levels emitted by VDTs. Reported results have mainly stated that measured radiation emissions from VDTs have been so low as to be negligible. Others have stated that there is more natural radiation in the environment in general than that emitted from VDTs. Health and Welfare Canada tested over 300 VDTs with their regula-

tion instruments capable of measuring very low frequency radiation. It, too, concluded that there is no danger of radiation from VDTs.

If these results can be applied to models of VDTs not tested, this would seem to remove most of the basis for fears about any long-term genetic effects or cancer. Nevertheless, it seems that such arguments must still be given some weight in order to ascertain as to whether current standards are strict enough to preclude even such remotely possible negative effects.

Meanwhile, the fear is real, and so far neither the tests nor their results have managed to put the misapprehensions to rest. For example, the National Action Committee on the Status of Women brief reminded us that standards of what is "safe" can change, as was the case with asbestos. The argument goes that perhaps old VDTs or inadequately maintained VDTs emit more radiation. Or perhaps some sort of synergism occurs in a worksite comprised of several VDTs that could amount to a hazard?

The following excerpts from the many briefs we received show the quandary we found ourselves in. For instance, the Canadian Air Line Employees' Association stated that at Dorval Airport in February, 1981, seven out of thirteen pregnant VDT operators miscarried. The Hospital Employees' Union, Local 180, British Columbia, told us that out of six pregnant VDT operators, two miscarried; and of the four babies carried full term, only one was born normal. The B.C. Federation of Labour reminded that four out of seven pregnant VDT operators in the classified ad department of the Toronto Star gave birth to babies with congenital defects.

Other groups insist that there is no health problem. For example, the Employers' Council of B.C. testified that, based on available medical evidence, VDTs pose no identifiable health or safety risk to pregnant operators or their unborn children; and The Federal Radiation Protection Bureau (Health and Welfare Canada) has stated that there is no reason for any person, male or female, young or old, pregnant or not, to be concerned about radiation health effects from VDTs.

Some experts suggest that VDTs may indeed cause birth defects but in an indirect way. Such a view comes from Montague Cohen of the McGill School of Medicine, who points out that, while VDT operators' complaints of eye strain, fatigue and stress do not, in themselves, lead to birth defects, they are very likely to result in increased smoking and the increased use of tranquillizers and other drugs - factors known to have an adverse effect on the unborn child.

These conflicting views and perceptions are compounded by the fact that many symptoms may emanate not only from the equipment itself but also by the organization of work and the design of the workplace. In other words, psychological and stress-related problems of working with microelectronic technology may manifest themselves physiologically.

Since we know very little about the potential long-term

effects of exposure to low-level radiation, it would be best to reduce avoidable x-ray exposure to an absolute minimum, on the assumption that no level of exposure is absolutely safe.

The Task Force can only conclude that the research performed to date on the question of possible radiation hazard from VDTs is unlikely to find acceptance as the final answer to these concerns. Despite the views and assurances of experts who have conducted these studies, these have not been successful in allaying fear and apprehension. We urge, therefore, that other public health methodologies be applied to investigate this concern as quickly as possible.

Of course, VDTs are not the only factor to be considered in assessing risk to the health of an unborn child. Any number of social and environmental factors, which can equally affect male and female reproductive systems, might be the cause of the clusters of miscarriages and birth defects reported from some VDT worksites. However, until more conclusive epidemiological research studies completely rule out VDT as a hazard to the fetus, the Task Force urges a precautionary approach. We recommend that a work standard be adopted that gives pregnant VDT operators the right to request and be granted reassignment to another position without loss of pay, seniority or benefits. We warmly commend employers who have already adopted this preventive measure.

Numerous other health problems have been linked to microelectronics equipment, especially VDTs. Limited research exists on the possible health hazards caused by polychorinated biphenyls (PCB's), used as insulating fluids in some VDTs. Concerns are only normal about the link between PCB concentration in offices where VDTs are used and spontaneous abortion, birth defects and skin disorders. In-depth research over time is also needed in this area. In addition, eye problems among VDT operators appear to be the most frequent, the most directly attributable to the demands of the job, and to have a physiological base. A typist looks primarily at the hard copy she is reproducing. In contrast, even the most experienced VDT operator must constantly shift the visual focus, from hard copy to screen to keyboard. Eyes constantly refocusing for distance and illumination can easily become overstrained, fatigued and blurred. Fortunately these symptoms disappear relatively quickly when the eyes are at rest. Additionally, vision that might have been adequate under other working conditions may be overstrained in a job using VDTs, and corrective lenses may be required.

Accordingly, the Task Force urges the appropriate authorities to establish health standards legislation to take into account the increased visual load imposed by such microelectronic equipment.

Some of the other physical complaints of VDT operators, such as head, shoulder, and neck problems, would also relate, in part, to the need to look frequently in different directions. Complaints touching on back and wrist seem to be more closely related to postural immobility throughout many hours on the

equipment. The Task Force believes that the alleviation of eye problems will also, in part, help alleviate some of these other physical symptoms.

We also recognize that some of these physical problems might be caused by ergonomic considerations related to either the equipment itself or the worksite. Some of these ergonomic factors, for example, might be legibility of the display screen, glare from the screen, non-adjustable office furniture (especially seating), the general standard and lay-out of illumination, and such. We therefore believe that ergonomic standards relating to office automation equipment and worksites should be established to cover such factors as physical environment, and office equipment and furniture.

A consensus holds that some of the health problems experienced by VDT operators could potentially be corrected by ergonomic measures. Others are psychosocial in nature, relating to various on-the-job factors that contribute to occupational stress.

Occupational stress is a complex concept. It cannot be measured directly. Nor can occupational stress be differentiated or dismissed easily from all other sources of stress most of us experience daily. Moreover, each person's capacity to adapt to stress differs and is dependent on a variety of factors unique to that person.

Nevertheless, behavioral scientists and industrial psychologists have determined indirect ways to measure on-the-job stress for groups of workers in specific worksites. These indirect measurements include excessive physical complaints, rates of absenteeism, alcoholism rates, and turn-over rates. They have also determined types of worksites and specific activities which, with statistical frequency, give rise to high incidences of such problems. The two most common correlates to occupational stress are:

1. the organization and content of the job;

2. the physical and interpersonal conditions in which a person works, including management style.

(ii) Job Content

On the basis of the briefs we received and the case studies carried out for us, we are convinced that microelectronics may not only change the work content but also the organization of work. It is apparent that depending on the change in work content, the level of required skills would change correspondingly.

Evidence shows that, in order to get the maximum return from the investment made in expensive office equipment, secretaries or clerk-typists -- mostly women -- may be required to become full-time word-processor operators. Their other tasks may be totally eliminated. Additionally, the pace of work is often accelerated to justify the purchase of the electronic machine -- which was procured to increase productivity. Depending on the downgrading or upgrading of skills, this could lead to a decrease or an increase in financial compensation and benefits.

Some research suggests that an unguided introduction of microelectronic technology will polarize workers into two more distinct classes: knowledge-workers who are highly skilled, and unskilled workers. People who have the ability and opportunity to acquire higher skills would be able to plan for and ultimately rise to positions requiring higher skills, hence higher pay and benefits. Workers lacking these abilities and opportunities would be left behind in routine, monotonous, dead-end work. This scenario is predicated on the demise of a "thinking" role for middle management. Clearly, the last word on this debate has not yet been heard. Canadian research in this area is in its infancy and will require a great deal more work before any definite conclusion can be drawn. However, recognizing the perception of a problem is the first step to preventive action. As women make up now most of the currently low-paying, dead-end office jobs with very little opportunity to move out of these ghettos, systematic and pro-active corrective steps by employers are essential in this regard.

(iii) Electronic Monitoring

The most serious manifestation of the introduction of new electronic office equipment is its utilization to monitor the quantity of work performance. For example, we heard about the added stress on telephone operators -- primarily women -- who hardly ever have time to breathe, being caught in "endless loops" and being machine supervised to produce more. This type of electronic monitoring also attempts to place limits on workers' freedom to move around. They appear to be tied to their machines under the ever-watching and ever-recording devices.

The Task Force regards close monitoring of work as an employment practice based on mistrust and lack of respect for basic human dignity. It is an infringement on the rights of the individual, an undesirable precedent that might be extended to other environments unless restrictions are put in place now. We strongly recommend that this practice be prohibited by law.

(iv) Organization of Work Time

Other major concerns workers, mainly women, expressed about automation and the quality of working life tended to centre on shift work, part-time work, and home work (cottage industry). We repeatedly heard that often management wants to recoup its capital investment in the newly acquired technology by encouraging shift work. Many witnesses pointed out the deleterious effects on health of shift work, such as disturbed sleep patterns, digestive disorders, continual drowsiness and reduced family interaction. For single parents, many of whom are women, shift work poses a special problem - reconciling their needs for earning a livelihood and their obligation to find 24 hour quality child care.

The introduction of microlectronic technology is expected to result in an increase in part-time work. At present, most part-time workers are women. Many do not receive the wages and benefits pro-rated to the hours they spend on the job. In addition, most part-time workers do not have the benefits of unionizaton. Undeniably, part-time work has many

advantages for women who must try to juggle and harmonize family and employment responsibilities. Moreover, women attempting to integrate themselves into a technological workplace require suitable opportunities for training, retraining, and promotions. However, most part-time work schedules do not provide such opportunities. (Part-time and other forms of work organization is now under study by Labour Canada's Inquiry Commission on Part-Time Work).

(v) Isolation

Another theme that surfaced repeatedly in the briefs we received and at our meetings was apprehension about working from home ("cottage industry"). We were cautioned that while working out of the home could be an ideal setup for some workers including specialized professionals, disabled workers, people living in rural areas and women with young children, the potential problems are significant. Women pointed out that there is a serious danger of exploitation in a system of home work. They further emphasized that home work can lead to the re-isolation of women in the home, and in the case of women with young children, burdening them with two jobs instead of one. Isolation might mean little or no opportunity for advancement. The absence of effective labour standards for home workers, such as proper wages, good working conditions, sickness, accident and pension benefits were cited often.

No one is sure how many women are now working at home, and are connected to main computers located at an employer's headquarters. But isolated stories in the newspapers and sporadic comments by employers about future possibilities of decentralization of work make this issue a matter of serious concern. Images of piece work are resurfacing. We realize that some workers will always make a choice about the location of their work. We also recognize that in the present economic circumstances women may not have any choice but to accept any available work. For this reason, adequate labour standards must be developed to protect home workers, and employers must fully comply with those standards.

Research has proved that workers cannot contribute their best efforts if the working environment is intimidating and lacking in human sensitivity. Clearly, the new technology, intended to eliminate "dirty" routine work and drudgery, does not have to mean a more fragmented and boring work environment. The concerns about the introduction of microelectronic technology, more particularly deskilling, the monotony of work, the social isolation of the worker, invasion of privacy, greater centralization of decision making and a more rigid and less human organization of work do not augur well for creating an environment that would lend itself to higher productivity.

It could be more beneficial to consider an alternative option. In this option, "stand-alone" machines might be considered rather than typing pools where terminals are connected to a central computer memory bank. Women can then use the new technology to free themselves from many of their routine and time-consuming tasks, and could

profitably use the time gained to take on more administrative, research-related and decision-making duties. In this manner, many clerical and service jobs can be enriched with value, rather than diminished.

The Task Force recognizes that human choice in selecting the equipment and deciding on how it is to be used is the key factor determining whether microelectronic technology will enrich or impoverish jobs and workers. As we indicated in our considerations on industrial relations, we believe management and labour problem-solving together can help ensure that dehumanizing effects are minimal and job enrichment is maximized.

Quality of working life policies and programmes are known to be effective in reducing occupational stress. Such programmes typically include worker participation in setting job standards and organization, better job design, rotating workers among a number of jobs to minimize monotony and boredom, and enriching job content. Many Western democratic countries have instituted programmes to promote and showcase work improvement practices.

In Canada, during the mid-seventies, the idea of quality of working life did not have much support. But currently the concept appears to be moderately popular. Many labour groups, including the United Auto Workers, the Communications Workers of Canada and the Public Service Alliance of Canada have become active in instituting quality of worklife programmes. Both Labour Canada and the Ontario Ministry of Labour have units to help encourage industry and labour in establishing such programmes.

Organizational improvements could result when workers who would be affected by technological change are consulted a) long before a decision concerning introduction of technology is made; b) at the time of selection of equipment (preferably ahead of time to influence its design and specifications); c) about work station design and final integration of the technological processes into the workplace.

It is evident to the Task Force that more research is required on diverse issues we have reviewed concerning quality of work and work environment. Standards legislated by the appropriate levels of government must be developed to take into account the numerous special work environment considerations relevant to microelectronics. Such standards, dealing with the equipment, the physical workplace, the job design, and the person-machine relations, should be based on well-documented research recommended to the governments by recognized bodies. We also affirm that psychosocial factors must be considered in setting health standards for microelectronic technology workplaces.

Most of the current Canadian approaches to safety and health in the workplace seem to have been preoccupied with imminent dangers, visible, touchable, and measurable hazards. But the worries we heard about during our meetings, the concerns Canadian workers expressed to us, and the current international understanding of safety and health on

the job calls for a more expansive consideration of health issues. These would include such things as stress, and the quality of working surroundings. The definition of health and safety recently adopted by the International Labour Organization seems to embrace this more expansive notion of health and safety and therefore is more closely alligned to workers' present concerns in this area. In this light, we recommend that federal labour legislation include a definition of health and that the government adopt appropriate measures to put into practice the intent and spirit of this definition to ameliorate the work environment.

.....

"The federal government should encourage research into the sociological, psychological and physical ramifications of isolating a child and a machine."

.....

The several issues considered by the Task Force have been numerous and multi-faceted. Our examination of them focused solely on the interrelationship between the microelectronic equipment, the design of the workplace, the organization of work and the adult workers. To the best of our knowledge, little formal research, if any, has been conducted on possible microelectronic health and safety impacts on children. We suggest that such work begin as soon as possible. As the use of computers increases at all levels of the school system, and as children spend more of their in-school time in addition to the time they may spend at home on computers, health and safety questions about children and microelectronics could become a major social concern. It is impossible to predict whether they will be the same or different from those of adults. What is of critical importance is uninhibited physical and mental growth of children. Experimental and field studies, both longitudinal and short-term, should begin immediately to determine what effects an increased exposure to, and use of microelectronic equipment, could have on the health of Canadian children.

E. Training and Education

Originally the Task Force believed that the topic of training and education would form one of the sub-units in its examination of the impacts of microelectronic technology on employment. Clearly the two topics are closely related, but while "training" implies the learning of skills primarily for the purpose of earning a living; "education" implies the more broadly based studies designed to help people understand their language, their laws, social customs and general culture in order to live fuller and richer lives. Ideally, skill training and humanistic education should be an integral part of all life experiences; both carefully interwoven with a lifetime of work and employment, plus a modicum of positive leisure activity. At a time when the value systems of traditional society are being challenged by the shift from an industrial to an information society, it is imperative that all Canadian citizens be given equal opportunities both to upgrade skill training for the purpose of getting and holding jobs, and also to participate in broader, higher education programmes in order to better understand the process of change.

If our modern society is to meet effectively the challenges now posed by microelectronic technology, then a greater adaptive flexibility must be built into all of our training and educational institutions as well as our places of work. People must be freed to alternate employment and study opportunities. In order to encourage new work styles and life styles, the strict structures which grew out of an inflexible mass, industrial society must now be modified and made more compatible with our newer evolving technologies which inevitably will result in more free time for everyone.

The new phenomenon which is affecting all educational disciplines can best be described as the "informatics" explosion. The computer and all computer-related technology is forcing changes in the learning of language and mathematics which form the basis of all our human endeavours.

As pointed out in the section on Triggering Technologies, citizens in today's and tomorrow's society will be faced with the various manifestations of informatics which are already creating a new culture. Informatics represent an educational crossroad that should be open to all citizens. The much needed methodology required to deal with it, however, will not emerge by itself; it must be developed by educators and taught to students of all classes and ages. Such things as how to register a problem, how to present the known factors of that problem, how to create a programme that is both accurate and functional, and how to determine the programming language to be used, represent only the beginnings of the new learning and skill demands.

Integrated Training

A fully integrated training programme in informatics can no longer remain an intent, it must become an imperative. Those wishing to grow with the changing times should learn how to master informatics because of its essential and universal utilitarian capacity. Such mastery calls for

the provision of suitable training at all levels of education, from pre-elementary to post-graduate university level. Full exposure to the many facets of hardware and software, and to specialized training programmes for emerging career opportunities must be provided for all students. Coupled with the needed skill training, must go further training in conceptualization.

As the hearings of the Task Force progressed, it became apparent that both training and education are so vital to a smooth social transition from a consumer/industrial age to an information/technological age that these issues must be given special emphasis. Virtually all of the submissions emphasized the importance of comprehensive, nationally integrated training and education policies. Canada's mass society, we were told, must become computer literate; otherwise we risk our ability to compete internationally. Our citizens have to be trained for the jobs and professions which will replace activities made redundant or obsolete by the "smart" machines. Two buzz phrases emerged: "life-long learning" and "life-long employment".

That a person's vocation and avocation should remain one, as was the case in an earlier agrarian society, seems highly improbable. On the other hand, that people will be required to do eight hours of routine work per day throughout a 5-or-6-day week in a gruelling industrial environment in order to put bread on the table is equally improbable.

While wages remain the fairest way of distributing wealth, and in the foreseeable future, while most people will continue to want to work for wages, they will also want work that is challenging, stimulating, invigorating and satisfying to the development of the whole person. For it is, after all work that gives human life purpose. But if, because of microelectronics, all human work hours are lessened, then alternative, constructive leisure activities must form a greater part of society's long range planning.

In the past, the motivation for much of our industrial and technological development has been to relieve individuals from inhuman toil and labour. As people have been freed from low-skilled jobs, the need for more highly skilled training has arisen. Further, as people rely less on physical strength and more on mental ability in order to earn a living, the interrelation of business, industry, and educational institutions becomes more complex. And finally, if more people do begin to work shorter hours and have more free time, it is likely that the need for more community organized activities and more service industries will emerge.

The advent of microelectronics plus any number of other significant factors which lie beyond the scope of the Task Force mandate now coalesce to compound the problems related to training, work, education, career development, leisure activity and life styles in general. Past educational systems, designed primarily to meet the needs of a simpler industrial or agrarian society, must now be redesigned to keep pace with changes in society in general. For example,

is the eleven year old youngster who stays home from school in order to work on a software package for his father's business to be charged with truancy? Or is the thirty-seven year old parent who dropped out of school in Grade 9 going to be able to re-enter the standard school system? Can a system develop which provides maximum flexibility allowing people of all ages to move freely in and out of educational institututions and job activities? Or are we doomed to become an even more categorized, classified and rigidly structured mass society?

The latter bleak forecast will happen only if the members of our society refuse to accept the challenge of the future and deny the opportunities to participate in the fundamental transformation not only of all social institutions, but also of our very sense of ourselves as working people in a planetary environment. While the briefs and arguments presented confirmed in the minds of the Task Force members the sense that the old rules governing our working lives no longer apply; these same submissions however also indicated that the willingness to work out new rules does exist in many segments of society.

The increased opportunities for higher education, the growing influence of women in society and in the workplace, the increasing importance of a developing third world in a global economy, the general concerns about environment, our developing modern communications systems, and most especially the demands of our microelectronic technology are forcing a total change of the old order of society. No group expressed the necessity for change more effectively than did the National Action Committee on the Status of Women who, while deploring the adverse impact of technological change on women, clearly stated the benefits of shorter work weeks, more time for family, and the "greater participation of everyone in an effective working democracy".

Since it would be folly to risk the social unrest of an intervening period while waiting for the gradual evolution of a younger and hopefully computer-educated generation to grow up and create this new democracy by taking charge of the labour market and economic order, we must face the complex task of giving all citizens a chance to become part of that newer order. This means undertaking the complex responsibility of changing and upgrading all of our training and educational systems at different levels simultaneously. Failure to do so can only reduce our chances to gain full employment and economic growth.

Training and Job Security

Unemployment results when various delays occur from the moment employees are laid off their jobs because of technological change until they can be retrained for new and different jobs. The remedy to this problem can hardly consist of resistance to the implementation of microelectronics when such implementation is tied to new growth in the Canadian economy. The changes caused by microelectronics should, as much as possible, be anticipated and every attempt be made to provide retraining opportunities while still retaining workers.

One of the obstacles of micro-electronic proliferation is the difficulty workers have not only in changing occupations within a company, but also in moving from one industry to another. As job offers change with the various delays caused by changes in the industrial structure, tension among workers increases and many workers can be without work sometimes for extended periods of time.

From the perspective of economic security, the purpose of job protection is to guarantee workers' income, and to indemnify them for supplementary expenses incurred by retraining for technological change. Two concepts of job security exist:

- protection of existing positions, by conceding to the workers an acquired right in the exercise of their functions; or

- the protection of the workers themselves, in giving them every chance to qualify themselves for all the most productive jobs.

The protection of existing positions from any change is not only the negation of technological progress, but also of social change of any kind. The concept of job permanence is an unrealistic notion of job security, because it also constitutes a long-term threat to the lasting economic security of workers themselves, since society is never static. On the other hand, job security rather than job permanence could become a reality if workers accept the necessity of maintaining minimum productivity. In order to keep production levels high during times of technological change, workers must be allowed to acquire the necessary qualifications to perform new tasks through retraining courses. It is essential that new skills be acquired before the workers are unemployed. This retraining can be accomplished by organizing evening courses or offering courses in the workplace during normal working hours.

In view of our present double-digit unemployment rate, training is an urgent labour priority for many groups in the work force, such as new entrants, women past their childbearing years re-entering the work force, laid-off workers, and the hard-core unemployed. The British Columbia Telephone Company and Employment and Immigration Minister the Honourable Lloyd Axworthy present similar views. According to B.C. Telephone, "Training is the key to adapting to technological change and increased investment." Employers must take the initiative in order to meet the growing skill and technical labour requirements of the new technology. While the private sector seems aware of the need to change Mr. Axworthy has conscientiously committed government support for "a first class training system in Canada." Providing people with opportunities for creative occupations is a top government priority. Again, Mr. Axworthy has made it abundantly clear that Canada needs to make "a truly co-operative effort to do more and better training, to anticipate more accurately and more quickly the labour market requirements of the future and to open our training systems to a host of innovations and creative forces."

National Training Act

In a major move to overhaul Canada's training system, Parliament passed a new National Training Program Act (Bill C-115) which was proclaimed on July 7, 1982, and which has allocated $1 billion for its implementation. It includes the following provisions:

1. A skills growth fund to provide capital and initial operating expenses to establish or modernize technical training facilities;

2. Training without a one-year delay so that potential trainees no longer have to wait one year after leaving school to be eligible for institutional training;

3. Special training allowances for laid-off apprentices who are being trained in occupations that are critically short of skilled labour;

4. Repealing the 52-week limit on courses which will be of particular benefit to those in high-skill training for occupations of national importance;

5. Training by groups other than employers so that industrial training councils or private training organizations will be eligible for assistance;

6. A Canadian Occupational Projection System to forecast labour's supply and demand;

7. Higher training allowance payments for laid-off workers in designated areas and industries who choose to retrain for high demand occupations;

8. Training outside Canada where necessary;

9. A simplification of administrative arrangements.

While the Task Force sees this Act as a major step in the right direction, we believe that further action is required to enable women to take full advantage of such programmes. Introductory courses in basic industrial and technical skills should be available in large scale, and courses in broader generic areas, such as computer literacy, should be encouraged to facilitate job mobility. In addition, any training and retraining programme ought to be available for women currently not employed or only employed on a part-time basis. More emphasis on greater career counselling is needed on providing both training and higher education opportunities for women, especially in the non-traditional occupations. Women need more information about suitable job training and help in dealing with problems such as technophobia. Last, but not least, progressive training opportunities would, of necessity, have to include provisions for support systems particularly essential to women working for pay. This support should include adequate day-care provisions, flexible hours, shared jobs, and the like.

Two additional policy questions related to training must be considered: first, the balance of responsibilities for training among governments, post-secondary training institutions, vocational schools, unions and employers; and second, the critical policy questions related to adequate funding for broader educational,

in addition to skill training programmes.

In practical terms, even larger, more profound questions must be asked:

1. What jobs should we train people for?

2. How shall the training be accomplished?

3. Who will pay for the needed training?

The Task Force accepts as axiomatic the view that a person's working life must now be interspersed with learning. Whether on one's own, on the job, or in educational institutions, ongoing learning will become a necessary feature of a technological society, and new ways must be developed in order to deal effectively with the non-traditional learners.

While many people in certain jobs and professions are already accustomed to ongoing study, others, especially unskilled workers, will find the necessity of getting more training a major challenge. They will need considerable societal support and understanding as they undertake this effort. To this end, citizens' organizations must cooperate in the development of life-learning and life-employment plans.

Desirable as such plans might be, however, it must be acknowledged that acquiring new skills is not the solution for everyone. To the person of forty who left school as a teenager because even then the learning process was agonizing, the thought of returning to school may still be intolerable.

For this reason, on-the-job training has one immediate advantage over other forms of training. The worker is being trained for a specific job or complex of jobs that exist and have a demand in the company or industry or sector in which the training is taking place. Other forms of training do not offer that guarantee. Nevertheless, employers cannot be expected to bear the entire burden of training and retraining. Responsibility for training and education should be shared among labour unions, employers, governments and educational institutions.

The average Japanese worker receives 65 hours of on-the-job training a year, as compared with 35 in the U.S. and 25 in Canada. This may be one reason why, despite the wide-spread use of microtechnology in Japan, the rate of unemployment is substantially lower than in Canada.

Training, Education and Self-Reliance

We believe that Canadians want to and should be encouraged to take charge of their own lives and to plan actively for their future training and educational needs using their own initiatives. Much as we agree that for each of us "learning is where you find it", assuring upward job mobility normally requires recognized degrees, certifications and other documentation. One direct way to assist Canadians to plan for retraining and continuing education is through a tax - savings plan for life-long learning.

A system which merely trains people, however, as opposed to educating them to think for them-

selves is inadequate for our sophisticated technological society. People should be aware of the necessity of learning how to live well in addition to learning how to earn a living. The Task Force heard again and again questions addressed to the need to find quality in the work-life experience, since work is what gives life purpose. While "manpower" planning remains a goal to be achieved; as the Report of the Task Force on Labour Market Development in the 1980's (Dodge report) suggests, it also remains an unrealistic goal as long as society is perceived by workers to be static. Society is organic, and there are as many uncontrollable forces affecting its change and growth as there are affecting change and growth in the natural world. Job permanence could only be achieved in a static society; job security is realized in an organic one.

In addition, then, to predicting the needs of the labour force and to providing training in skills to meet those needs, the federal and provincial governments must devise imaginative ways of putting more money into educating people to be resourceful and responsible and willing to assume responsibility for their own lives. To do this, Canada should give more consideration to the development of a cohesive national education policy.

Preparing for the Future

Constitutionally, education, as distinct from training, is solely a provincial responsibility. Our policy considerations and recommendations in this area, therefore, are more in the nature of observations. First and foremost, we see as a matter of urgency the need to review all aspects of the present educational systems in light of challenges stemming from the microelectronic era.

While it has been accepted as policy that training is a priority, there is a great deal of vagueness concerning the question of what jobs the training should be aimed at.

The general answer is, in the high technology industries, in the equipment and services they provide. It was also generally accepted that the spinoffs from the electronics industry would increase demands on service areas, such as child care workers, geriatric workers, counsellors and trainers. A Canadian software industry suggests another people-intensive growth area. Predicting the kinds of employment and the new jobs that may develop as the information age advances is risky business. No one could have foretold at the time of the event of the automobile, the new jobs, the kinds of service industries, and the changes in society which now can be traced to the use of the motor car. Similarly, no one today can accurately predict how society will change or what new growth areas will result from the spread of microelectronics. It is to be hoped that once the Canadian Occupational Projection System (COPS) is operational, our ability to forecast labour markets supply and demand needs will improve.

What is clear is the necessity of including in skill training programmes those other subjects which develop human initiative and train the mind. Attempts at predicting which types of training or what courses should be taken

by what specific groups has never proven very satisfactory. In a free working democracy, the choices for training or education for specific jobs might be better left to the informed workers who, if properly motivated and counselled, will know how to adapt and transfer learned skills to the vagaries of the labour market. We now know that whole areas of information we learned in school are being eroded. In many fields, the scientific education of 20 years ago is now regarded as obsolete. Clearly, a new view of what education should be all about is needed. Fundamental to any new system is the need to teach persons to develop their own individual initiative, and to use their own innate abilities.

As machines assume more "smart" functions and interconnect with data banks of all sorts, our concept of education will have to change considerably. The process skills of conscious learning will become building blocks for acquiring higher-level skills and applying these skills to all sorts of situations. Problem solving, decision-making, interpersonal relations and values clarification must become areas of basic study.

Major curriculum changes will have to occur. Computer literacy must become as basic a goal of our education system, as the traditional three R's: reading, writing and arithmetic. Scientific education, the "how" of our world must become more central to our education system and to our thinking processes. Mathematics and logic, that terrifying categorical imperative of microelectronics, will have to move much more to the fore of our educational system. Reality considerations, such as job opportunities and requirements, awareness of labour codes, collective agreements and work responsibilities must be more closely integrated into our life skills curricula. While not in any way denigrating our present notions of a general education, clearly base curriculum planning will have to be expanded to include these subjects normally left as high school or university options. More traditional arts subjects, not fewer, will somehow have to be interspersed throughout all educational programmes and levels of education.

In addition, educational policies and programmes must be encouraged and expanded to assist in the elimination of traditional sex stereotyping. The Task Force draws attention to the impacts of such stereotyping in society at large, and in the labour force and labour market in particular. If women perceive themselves and are perceived by others primarily as a secondary labour force, Canada is denied the full use of the talents of over half our population. Stereotyping aggravates the potential vulnerability of women in any technological transition period by reinforcing their ghettoization in particular areas of job concentration. Neither men nor women are natural leaders, natural prime movers, natural bread-winners or natural homemakers. Women and men must be equally encouraged to develop their talents and abilities, and motivated to learn a variety of practical skills. Both must be equally accepted in the market place for their distinctive contributions. Only then will the democratic ideal of opportunity to

work and contribute to our society apply equally, in practice, to Canadian women and men.

Both employers and governments, then, must consider not only the problems of perceived shortages of people with specialized skills and knowledge, but also they must advocate the hiring of people who have demonstrated the ability and capacity to learn. Since occupational forecasting is, as yet, undeveloped and therefore unreliable, both employers and governments must consider long-term educational policies as well as more effective short-term training programmes.

In conclusion, then as has already been stated, governments, business and labour, and all training and educational institutions, from pre-school centres to post-graduate studies, must start at once to devise a massive cooperative education process that will both dispel the ignorance surrounding the chip and provide training in the positive use of microlectronic equipment. It is essential that the training and educational systems be oriented toward the evolving careers of the future. Although adapting to change is invariably an individual concern, governments, employers, and educators have a major responsibility to adjust the systems and structures of society so that no person is left technologically illiterate.

CHAPTER IV
CONCLUSIONS

Agenda for Action

In conclusion, let us look back at the beginning. It was the apprehensions about an overwhelming rapid change triggered by microelectronic technology that created this Task Force and set us off with an extraordinary mandate. We state confidently now, as we did in the beginning, that new technology by itself is neither good nor bad. Its positive or negative effects depend entirely on the use made of it.

It must also be stated that, thus far Canada's efforts related to research, development, and the application of high technology appear to the Task Force to be rudderless. Islands of isolated success stories such as in Kanata, Ontario, did not happen by design, but through the imagination and initiative of individuals and in the absence of a well-defined, coherent, national strategy. Micro-chip technology has immense possibilities to increase productivity, enhance economic growth, and improve the quality of Canadian life if everyone - citizens, labour, business, governments - cooperatively seize the opportunity to make it serve national economic and social goals. In essence, properly handled, this new generation of technology can contribute in a significant manner to an economic renaissance in Canada.

Micro-chip has ushered in a scope of change unparalleled in our times. There is no going back; there can only be a continuing move forward, but the forward movement can be accomplished with less pain and social upheaval if people form partnerships, sharing hardships and hopes equitably. If higher productivity is to be the stated goal, then the concerns of the people of Canada must be paramount. That means, determined job creation and a more contemporary process of enlisting labour's participation in the decision-making process. In our mutual interest, adversarial inclinations must give way to cooperation. Our Prime Minister, the Right Honourable Pierre Elliott Trudeau, stated:

> "... we are living in such a complex economic society that it is impossible to govern it, to make it work, to ensure its recovery and development without cooperation between the main economic decision makers. There is no way in which the state alone, whether it be expressing itself through the government of Canada or through the provincial governments, can just ensure economic recovery and economic development in this country."

Speaking in Winnipeg on Labour Day, 1982, the Honourable Charles Caccia, Federal Minister of Labour, suggested that we approach the twenty-first century issues with a made-in Canada social partnership that cultivates mutual confidence and generates consensus.

As long we have double digit unemployment, it would certainly be shortsighted if our policies failed to address the perception that technology, by itself, replaces jobs. A genuine willingness to listen to labour's concerns and to understand labour's role in economic decision-making is a must.

Any decision to go all out in favour of assigning highest priority to the development, promotion and adoption of high technology, including microelectronics should rest on a twin imperative: (1) sensitivity to people's concerns and, (2) a process characterized by greater cooperation.

(1) People: Putting into place a set of effecive adjustment mechanisms, such as training, retraining, reassignments without loss of wages and benefits and so forth -- as shock absorbers to cushon any negative consequences that might result from a full-fledged integration of new technology in the workplace.

(2) Process: A set of fresh approaches and new mechanisms to understand labour's role and to accommodate their ability to participate in the decision-making process, and become a truly social and economic partner in our society.

What seems to be essential is the development of a climate which is founded on a notion of social partnership and the need for sharing of economic and social benefits. With this as our anchor, Canadians can benefit fully from our impending scientific march into the future.

The precondition for our microelectronic boom is an environment conducive to growth: appropriate support for research and innovation, incentives for the development of the high technology industry, and social receptivity. This would lay the foundation for a prosperous Canadian-owned, managed and operated industry which would in turn, create new employment. Stated unequivocally, given our present high rates of unemployment, expanded job creation through microelectronics is not only necessary but imperative.

The kind of unique inventiveness that has succeeded in providing the CANADARM for the United States Space Shuttle can be made to work for the social and economic benefit of the people of Canada. Only this inventiveness will help us to mitigate the untold social as well as economic cost of unemployment. Human beings, the most valuable resource of any nation, cannot be made to suffer the miseries of nineteenth century problems when solutions befitting the twenty-first century are possible.

Canada is a signatory to many international labour charters, declarations, conventions and recommendations. Most of these documents pledge the right to work, and aim at the creation of full employment. Against this background, Canadian workers and their representatives perceive the absence of productive participation in the economy as Canada's failure to live up to her international commitments. As long as this perception is strong, irrespective of their fatalistic acceptance that technology is here to stay, workers will not be able to contribute their best efforts toward the integration of a technology which potentially represents a threat to their job prospects.

Every possible step must be taken by the federal government to enable the private sector -- primarily in the microelectronic and related industries -- to create

jobs in research, development, manufacturing, marketing and application. At the same time policy-makers must anticipate as far as possible to do so, where and to what extent changes in the labour market might occur, and design and institute proper adjustment mechanisms for the transitional period.

Earlier, we expressed our belief that, properly handled, microelectronic technology can help regain our economic health. It will depend on the option we choose to adopt.

Three options are possible: governments can

(a) choose not to intervene in the economy, just let whatever developments centering on microelectronics occur as and when they may;

(b) intervene to improve on Canada's competitive abilities; or

(c) bring all principal decision-makers in the economy together with the governments' active encouragement to build a cooperative framework.

Cooperation and cohesion for social and economic vigour is, at this time, indispensable. It is the third option. It is the only sensible and feasible option to follow. Assuming that the "main economic decision-makers" are anxious to nurture more fruitful labour-management relations, they would want to consider very carefully the recommendations we have made, to start constructing that framework for cooperation and equal partnership so essential for our country seeking to regain economic health and social well-being.

Although many of our recommendations are aimed at governments, we urge Canadians, particularly those who shared their concerns and views with us, to take the necessary steps to ensure that impersonal approaches too frequently adopted by technophiles are prevented, and to bring some balance in favour of people, especially in light of high unemployment and growing welfare rolls.

That people have a greater capacity to learn than once thought possible is a concept now widely accepted. That Canadians must deal with the challenges of computer technology is a fact of life. As society once adapted to the automobile, it must now adapt to microelectronic technology. The microelectronic era is here to stay; hence it is imperative to assess all the risks and opportunities, sector by sector to obtain the technology's maximum benefits.

This report represents our attempt to fulfill that imperative. We believe the Canadian Centre of Technology, Work, and Human Priorities, when it is established, will undertake varied tasks which are clearly beyond the scope of this report. For Canada, now and in the near future, we believe our recommendations, if endorsed and implemented, would help facilitate a relatively smooth acceptance of microelectronics in the workplace and in society, and lead to the creation of long-term employment.

In view of the vast lack of understanding that exists about

microelectronics, governments, employers, employees, educators, scientists, and futurists must now form a coalition helping to raise the consciousness of everyone within the social spectrum to the challenge of creating a new age for humanity where machines serve people.

Throughout history, new technologies have altered our basic concepts of how the world works and what our place in it might be. The time and energy spent by this Task Force will have been worthwhile, if this report aids in alerting Canadians to the fact that technological change is inevitable and that working together we can perhaps use evolving technologies to bring about a better future with new opportunities for people.

CHAPTER V
APPENDICES

Table Related to Chapter C: Industrial Relations

Technological Change Provisions in Collective Agreement
Under Part V of the Labour Code
(As of 19th May 1982)

Provisions	Agreements		Employees	
	No.	%	No.	%
Notice and/or Consultation Prior to Introduction of Technological Change				
Less Than 3 Months	64	6.2	11 926	3.6
3 Months to 6 Months	165	16.2	181 270	55.6
6 Months to 12 Months	12	1.1	13 220	4.0
12 Months or More	1	0.0	20	0.0
Other	35	3.4	7 975	2.4
No Provision	741	72.7	111 449	34.2
Total	1 018	100.0	325 860	100.0
Training or Retraining (Technological Change)				
Displaced Employees OJT on New Equipment	108	10.6	102 545	32.4
Displaced Employee OJT for Another Job and on New Equipment	58	5.6	37 275	11.4
Laid Off Employee Retraining at Employer's Expense	13	1.2	11 225	3.4
Other	7	0.6	2 495	0.7
No Provision	832	81.7	172 320	52.8
Total	1 018	100.0	325 860	100.0
Relocation Allowance (Technological Change)				
Employer Pays Full Cost	38	3.7	141 860	43.5
Employer Pays Percent of Cost	1	0.0	25	0.0
Employer Pays Percent of Cost by Maximum Specified	3	0.2	215	0.0
Other	2	0.1	535	0.1
No Provision	974	95.6	183 225	56.2
Total	1 018	100.0	325 860	100.0

Table (continued)

Provisions	Agreements		Employees	
	No.	%	No.	%
Labour-Management Committee (Technological Change)				
Committee Studies Problems	45	4.4	45 750	14.0
Committee has Specific Administrative Duties	4	0.3	360	0.1
Committee Studies Problems and has Specific Administrative Duties	5	0.4	1 945	0.5
Other	3	0.2	1 125	0.3
No Provision	961	94.4	276 680	84.9
Total	1 018	100.0	325 860	100.0
Employment Security (Technological Change)				
Some Form of Wage or Employment Guarantee (other than SUB or Severance Pay)	115	11.2	113 980	34.9
Attrition	2	0.1	275	0.0
Distribution of Work (includes Short Workweek, Extended Vacation)	1	0.0	25	0.0
Some Form of Wage or Employment Guarantee (other than SUB or Severance Pay), Attrition, and/or Distribution of Work	4	0.3	7 575	2.3
Other	2	0.1	190	0.0
No Provision	894	87.8	203 815	62.5
Total	1 018	100.0	325 860	100.0
Notice of Lay-off (Technological Change)				
Less Than 3 Months	23	2.2	17 105	5.2
3 Months to 6 Months	47	4.6	7 470	2.2
6 Months to 12 Months	3	0.2	180	0.0
Other (includes Indefinite Period or One Not Specified)	3	0.2	115	0.0
No Provision	942	92.5	300 990	92.3
Total	1 018	100.0	325 860	100.0
Re-opener Clause (Technological Change-Wages & Working Conditions)				
Provision Exists	9	0.8	1 365	0.4
As Provided by Law	3	0.2	1 560	0.4
No Provision	1 006	98.8	322 935	99.1
Total	1 018	100.0	325 860	100.0
Work Sharing Techniques (Technological Change)				
Job Rotation	1	0.0	25	0.0
No Provision	1 017	99.9	325 835	99.9
Total	1 018	100.0	325 860	100.0

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DPA Consulting Ltd.
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Management Consultants International Inc.
Toronto

Michel Lafontaine
TAMEC Inc.
Montréal

Russell M. Wills
Vancouver

Robert Moir
Ottawa

Deanna and Dr. Saul Silverman
Silverman Consulting Services Ltd.
Ottawa

Eva Bedard
Ottawa

SUBMISSIONS TO THE TASK FORCE BY MEANS OF PERSONAL APPEARANCE AT PUBLIC HEARINGS

Toronto - June 21, 1982

Canadian Federation of Independent Businesses,
Mr. Jim Bennett,
Director of National Affairs.

Canadian Federation of Labour,
Mr. James A. McCambly,
President, and
Mr. Ken Rose,
Vice-President.

Canadian Pacific Limited,
Mr. George Sekely,
Director of Information Systems.

Michael Cassidy, M.P.P.

Communications Workers of Canada,
Mr. Fred Pomeroy,
President.

Ontario Federation of Labour,
Mr. Ray Hainsworth,
Education Director.

United Steel Workers of America,
Mr. A.E. Munro,
Assistant to National Director.

Vancouver - July 5, 1982

Academic Council of
British Columbia,
Mr. Donald Couch,
Executive Director.

British Columbia Federation
of Labour,
Ms. A. Davidson,
Director of Women's Programs.

British Columbia Telephone
Company,
Mr. D.W. Champion,
Vice President,
Personnel and Industrial
Relations.

Brotherhood of Railway and
Airline Clerks,
Ms. Christine Micklewright,
Staff Representative.

City of Vancouver,
Ms. Reva Dexter,
Coordinator,
Equal Employment Opportunities
Program.

Employers' Council of
British Columbia,
Mr. Bert Hawrysh,
Vice President of Employee
Relations.

Hospital Employees' Union,
Ms. Jean Greatbatch,
Job Analyst.

Telecommunications Workers'
Union,
Ms. Linda Hebert,
Business Agent.

Edmonton - July 6, 1982

Alberta Federation of Labour,
Mr. Don Aitken,
General Services Director.

Alberta Microelectronics
Development and Application
Centre,
Mr. John Robson,
General Manager.

Dr. Stephen Peitchinis,
Department of Economics,
University of Calgary.

Mr. Martin Saradyck,
Department of Administrative
Services,
Mount Royal College.

Montreal - July 15, 1982

AES Limited,
Ms. Barbara Steinberg,
Manager,
Organizational Training
and Development.

Bell Canada,
Mr. Ian Hay,
Director of Labour Relations.

Canadian Advisory Council on
the Status of Women,
Ms. Monique Jérome Forget,
Vice President.

Canadian Business Equipment
Manufacturers' Association,
Mr. Conrad Maheux,
Chairman,
Standards Committee.

Canadian Federation of
Communication Workers' Union,
Mr. Boris Mather,
President.

Canadian Vocational Association,
Mr. Jacques Dubé,
President.

Centre Locale de Service Communautaire,
Ms. Marie Bellemare,
Researcher.

Fédération des Femmes du Québec,
Ms. Lucille Roy,
Le Comité ad hoc - microtechnologie.

Gamma,
Mr. Hadj Benyahia,
Senior Economist.

Halifax - July 16, 1982

Canadian Airline Employees' Association,
Mr. Tom Saunders,
President.

Institute of Public Affairs,
Dalhousie University,
Mr. K. Scott Wood.

National Action Committee of the Status of Women,
Ms. Michelle Swenarchuk,
Chairperson,
Employment Committee.

National Union of Provincial Government Employees,
Mr. Bill Reid,
Secretary-Treasurer.

Nova Scotia Advisory Council on Women,
Ms. Florence Wall,
Past President.

Nova Scotia Federation of Labour,
Ms. Gwen Wolfe.

Centre for Research on Administrative Sciences,
Mr. Georges Wybouw,
Director,
University of Moncton.

Ottawa - August 11, 1982

Canadian Union of Public Employees,
Ms. Jane Stinson,
Research Assistant.

Ms. Rhonda Love,
Assistant Professor,
Behavioural Science,
Faculty of Medicine,
University of Toronto.

Ms. Heather Menzies,
Author "Women and the Chip".

Ottawa - August 19, 1982

Canadian Advanced Technology Association,
Mr. Robert S. Long,
Executive Director.

Written Submissions by those who did not appear at Public Hearing

Alberta Canadian Congress for Learning Opportunities for Women: Committee on the Impact of Micro-Technology, Edmonton, Alberta.

Leiba Aronoff, Montreal, Quebec.

Canadian Advisory Council on the Status of Women, Ottawa, Ontario.

Canadian Bankers' Association, Toronto, Ontario.

Canadian Congress for Learning Opportunities for Women: Women and Technology Committee, Ottawa, Ontario.

Canadian Guidance and Counselling Association, Ottawa, Ontario.

Canadian Home Economics Association, Ottawa, Ontario.

Canadian Information Processing Society, Calgary, Alberta.

Canadian Manufacturers' Association, Toronto, Ontario.

Canadian Research Institute for the Advancement of Women, Ottawa, Ontario.

Canadian Teachers' Federation, Ottawa, Ontario.

Canadian Telephone Employees' Association, Toronto, Ontario.

Federation of Women Teachers' Association, Toronto, Ontario.

Alexa McDonough, MLA, Leader - Nova Scotia NDP, Halifax, Nova Scotia.

Pilipino Bayanihan of Mississauga, Mississauga, Ontario.

P.E.I. Advisory Council on the Status of Women, Charlottetown, P.E.I.

Public Service Alliance of Canada, Ottawa, Ontario.

Union Internationale des Employés Professionnels et de Bureau, Montréal, Québec.

University of Western Ontario, Faculty of Social Sciences, London, Ontario.

York University, Faculty of Environmental Studies, Downsview, Ontario.

Young Women's Christian Association (YWCA): Social Issues Committee, Calgary, Alberta.

Testimony from Federal Government Departments

Health and Welfare Canada - August 11, 1982

Dr. Peter J. Waight,
Chief,
Consumer and Clinical
Radiation Hazards Division,
Radiation Protection Bureau.

Mr. Paul Dvorak,
Acting Head,
X-Ray Section.

Minister of State for Economic Development - August 11, 1982

Mr. S.B. Salley,
Director,
Policy Branch.

Mr. Chris Burke,
Officer.

Economic Council of Canada - August 11, 1982

Dr. Peter M. Cornell,
Director.

Mr. Neil Swan,
Director,
Technological Change Growth,
Productivity Section.

Dr. Keith Newton,
Director of Labour Market Groups.

Mr. Abrar Hasan,
Senior Researcher.

Canadian Employment and Immigration Commission - August 11, 1982

Mr. Michael Rochon,
Director General,
Canadian Occupational Projections System.

Mr. Pierre Leclerc,
Senior Industrial Consultant,
Labour Market Planning &
Adjustment Branch.

Ministry of State for Science and Technology - August 11, 1982

Mr. Donald Thom,
Assistant Secretary,
Industry Branch.

Industry, Trade and Commerce - Department of Regional Industrial Expansion - August 11, 1982

Mr. Roy Woodbridge, Chief,
Policy and Analysis,
Support for Technology Enhanced
Productivity (STEP).

Mr. S.L. Dubeau,
Chief,
Microelectronics and
Instrumentation.

Mr. J. Rywack,
Officer,
Electrical and Electronics
Branch.

Labour Canada - August 19, 1982

Mr. Mark Mueller,
Acting Director General,
Central Analytical
Services Branch.

Mr. James W. McLellan,
Director,
Occupational Safety and Health
Branch.

Mr. Michael McDermott,
Industrial Relations Advisor,
Mediation and Conciliation Branch.

Department of Communications - August 19, 1982

Mr. D.F. Parkhill,
Assistant Deputy Minister,
Department of Communications.

Mr. Jim Feeley,
Director General,
Informatics Application
Management.

Dr. Can Le,
Director,
Economics Analysis Division.

Dr. Dorothy Phillips,
Director,
Behavioural Research and
Evaluation.

Ms. Mary Meloshe,
Director,
Social and New Services Policy.

Mr. Don Stephenson,
Executive Assistant,
Deputy Minister.

Experts who Contributed to National and International Briefings

Ottawa, Ontario
May 14, 1982

Dr. Roger Kaye,
Carleton University.

Mr. Maurice Estabrooks,
Office Communications Systems
Program,
Department of Communications.

San Francisco, California - June 30 - July 2, 1982

Mr. William C. Grindley,
Associate Executive Director,
Mr. James Ogilvy
International Development Centre,
Stanford Research Institute.

Mr. David Nitzan,
Director,
Robotics Department,
Stanford Research Institute.

Dr. John Linvill,
Stanford University,
Centre for Integrated Systems.

Mr. Fred Zieber,
Vice-President,
Mr. Ken McKenzie
Dataquest.

Dr. William Spencer,
Science Centre,
Xerox Laboratories.

Mr. Phil Roybal,
Manager,
Communications Program,
Apple Computer.

Mr. Mitchell Bohn,
Vice-President,
Research and Development,
LSI Logic Corporation.

Prof. Donald Dunn,
Department of Engineering,
Economic Systems,
Stanford University.

Mr. Adam Osborne,
President,
Ms. Georgette Psaris,
Vice-President,
Osborne Computer Corporation.

Mr. Martin Stone,
Consul,
Antoinette Dekir,
Vice-Consul,
Canadian Consulate.

London, England - July 7-9, 1982

Mr. A.R. Norman,
Technology Information Unit,
Cabinet Office,
Government of the United Kingdom.

Mrs. R.S. Catto,
Mr. Richard Wragg,
Department of Employment and Productivity.

Mr. Clive Jenkins,
General Secretary,
Mr. Barry Sherman,
Director of Research,
Association of Scientific,
Technical and Managerial Staffs.

Mr. Patrick Burns,
Assistant Economics Department,
Ms. Ann Gibson,
Organization and Industrial Relations,
Women's Advisory Committee,
Trade Union Congress.

Mr. Richard Worsley,
Social Affairs Directorate,
Confederation of British Industry.

Mr. Larry Wagg,
Labour Counsellor,
Canadian High Commission.

Tours

AES Data Limited,
Montréal, Québec.
May 30, 1982

Micom,
Montréal, Québec.
May 30, 1982

Mitel,
Ottawa, Ontario.
August 19, 1982

Conferences

Work Shop - Microelectronics - Information, Technology and Canadian Society,
Queen's University,
Kingston, Ontario.
May 5-7, 1982

Learned Societies' Conference,
Ottawa, Ontario.
June 4, 1982

Changing Images and Changing Directions,
Queen's University,
Kingston, Ontario.
June 11-12, 1982

Women and the Impact of Microtechnology Conference,
Ottawa, Ontario.
June 25-27, 1982

5th Generation Computer Conference,
London, England.
July 7-9, 1982

Mandate

The Task Force on Microelectronics and Employment was created on March 17, 1982, by the Minister of Labour, the Honourable Charles L. Caccia, to examine the implications of microelectronic technology on the workplace. It was felt that in the prevailing atmosphere of uncertainty and apprehension, a fact-finding Task Force was needed to address the concerns of all Canadians while dispelling the myths about microelectronic technology and its perceived effects.

The mandate of the Task Force was therefore directed toward examining the methods by which microelectronic technology is being incorporated into the workplace, the extent to which this has already occurred, and the implications of this process on working persons. The focus was cast primarily, though not exclusively, on industries and organizations falling under the Canada Labour Code, with a view to proposing amendments that would make the Code more responsive to the needs of working people. Special emphasis was given to the employment concerns of women, who are feared to be disproportionately affected by the new technologies.

In order to reflect the varied interests implied in the issue of technological change, the Task Force members were chosen for their diverse backgrounds and perspectives. It was felt that in this way a more vigorous critical analysis could be carried out on the variety of public viewpoints presented.

Since it became clear that continued development and research in microelectronic technology is the path to an internationally competitive future for Canada, it became apparent that a balance would have to be achieved between this goal of productivity growth, and the legitimate labour concerns, with possible employment upheavals, the quality of working life, and the health and safety factors that need to be considered when introducing the new technology into the work environment.

To receive the views of all concerned Canadians, the Task Force held public discussions in six cities across the country, meeting with business associations, labour unions and women's organizations. In total, thirty-nine presentations were made to the Task Force, and twenty-one briefs were received from groups and individuals who did not appear at the public meetings.

The purpose of the Task Force then became the analysis, assessment, refinement and consolidation of the views received, with the aim of making specific recommendations for policy change, since much public concern was expressed for making a concerted effort toward action that would benefit all Canadians.

To coordinate the activities of the Task Force research, administration and public relations the Task Force engaged Murray S. Hardie to act as its Executive Director. An office was established for the duration of the Task Force in the premises of Labour Canada in Hull, Québec.

Through this office all research activities were coordinated, experts and witnesses contacted, meetings of the Task Force scheduled, agendas for the public meetings finalized, information provided to interested parties, and liaison with the media carried out.

The Task Force also engaged researchers and consultants to examine various issues of direct relevance to its mandate. They are as follows:

Dr. Lorna Marsden,
Urban Dimensions Ltd.,
Toronto.

Dr. S. Muthuchidambram,
University of Regina,
Regina.

Russell Wilkins,
Institute for Research on
Public Policy,
Toronto.

Robert Arnold Russel,
Orba Inc.,
Toronto.

Fred Thompson,
DPA Consulting Ltd.,
Ottawa.

Michael Harrison,
Management Consultants
International Inc.,
Toronto.

Michel Lafontaine,
TAMEC Inc.,
Montréal.

Russell M. Wills,
Vancouver.

Robert Moir,
Ottawa.

Deanna and Dr. Saul Silverman,
Silverman Consulting Services,
Ottawa.

Gordon DiGiacomo,
Ottawa.

In addition, needed information was culled from government, private sector and academic sources, and presented for the members' consideration. However, the major source of information and opinion was derived from a thorough review and analysis of the content of the briefs and public hearings. This report is thus largely a reflection of the concerns of Canadians met with during the six months of the Task Force's life.

Glossary of Technical Terms

BIT: An abbreviation of binary digit, one of the two numbers -- 0 and 1 -- used to encode computer data. A bit is expressed by a high or low electrical voltage.

BUBBLE MEMORY: The special magnetic regions formed within films of crystalline garnet. They provide very dense memory, and, as they can be moved magnetically, they allow fast data motion.

CHIP: A small piece of silicon that is a complete semiconductor device, or integrated circuit.

DATA: The information used by a computer.

ERGONOMICS: Derived from the Greek word Ergon - work and Nomos - natural laws of. The word has become synonymous with the study of the problems of people in adjusting to their environment; especially the science that seeks to adapt work or working conditions to suit the worker.

EPROM: (Erasable Programmable Read-Only Memory). A type of memory in which stored information can be erased by ultraviolet light beamed in a window of the chip package. EPROMs can be reprogrammed repeatedly.

FIRMWARE: A program permanently stored in a special part of the processor whose instructions are used by all other programs in the computer. Because this program cannot be changed or removed from the computer, it is halfway between software and hardware.

GATE: This term has two distinct meanings in semiconductor technology: the controlling element of certain transistors, or a logic circuit that has two or more inputs that control one output.

HARDWARE: The machines that make up a computer system.

INTEGRATED CIRCUIT: A semiconductor circuit combining many electronic components in a single substrate, usually silicon.

LASER BEAM: A highly-concentrated beam of light, used in a variety of ways by some computers.

K: Usually an abbreviation for kilo (1 000). A 1K memory chip, however, contains 1 024 bits because it is a binary device based on powers of 2. Thus a 64K memory can store 65 536 bits of information (i.e. 64 x 1 024).

LSI: (Large Scale Integration). This term is generally applied to integrated circuits containing from 500 to perhaps 20 000 logic gates, consisting of transistors, or 1 000 to 64 000 bits of memory.

LOGIC: The fundamental principles and the connection of circuit elements for computation in computers.

MASK: A glass photographic plate that contains the circuit pattern used in the silicon-chip fabrication process.

MEMORY CHIP: A semiconductor device that stores information in the form of electrical charges.

MICROPROCESSOR: An integrated circuit that provides, in one chip, functions equivalent to those contained in the central processing unit of a computer. A microprocessor interprets and executes instructions and usually incorporates arithmetic capabilities and some memory.

OPERATING SYSTEM: The program that is permanently in main storage, reading in and supervising all the other programs. The computer manufacturer normally provides the operating system.

OPTICAL COMPUTERS: Computers processing pulses of light rather than electrical signals.

OPTICAL DISCS: Computer storage of high density, similar to videodiscs (the visual equivalent of records). Information is read, and now even recorded, by lasers.

RAM: (Random Access Memory). A memory in which any piece of information can be independently stored or retrieved. Its contents are only held temporarily.

ROM: (Read Only Memory). A memory chip in which information is permanently stored during the manufacturing process.

SEMICONDUCTOR: An element whose electrical conductivity is less than that of a conductor, such as copper, and greater than that of an insulator such as glass.

SOFTWARE: Strictly, the programs sold by manufacturers with their computers, although often applied to all programs.

TRANSISTOR: A semiconductor device that acts primarily either as an amplifier or as a current switch.

VLSI: (Very Large-Scale Integration). Integrated circuits containing (in the order of) 20 000 logic gates, or more than 64 000 bits of memory.